SCIENTIFIC AMERICAN

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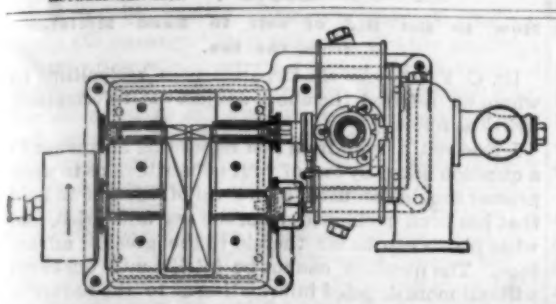

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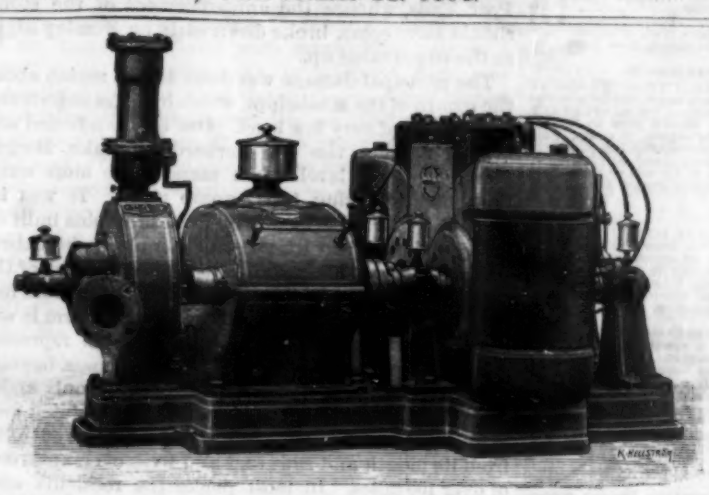

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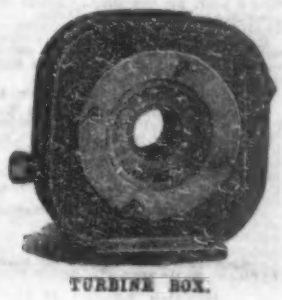


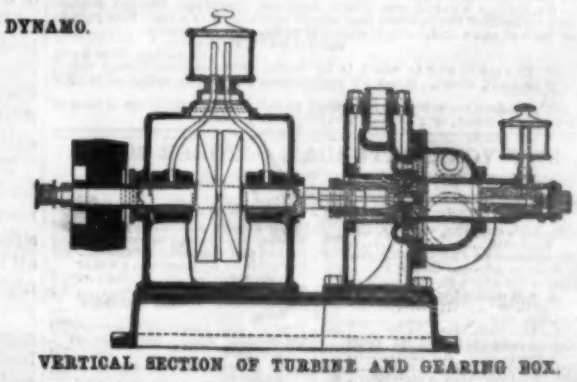
TURBINE BOX.

THE COGWHEEL.

NOZZLE.

THE GOVERNOR.

TURBINE WHEEL, SHAFT AND PINION.



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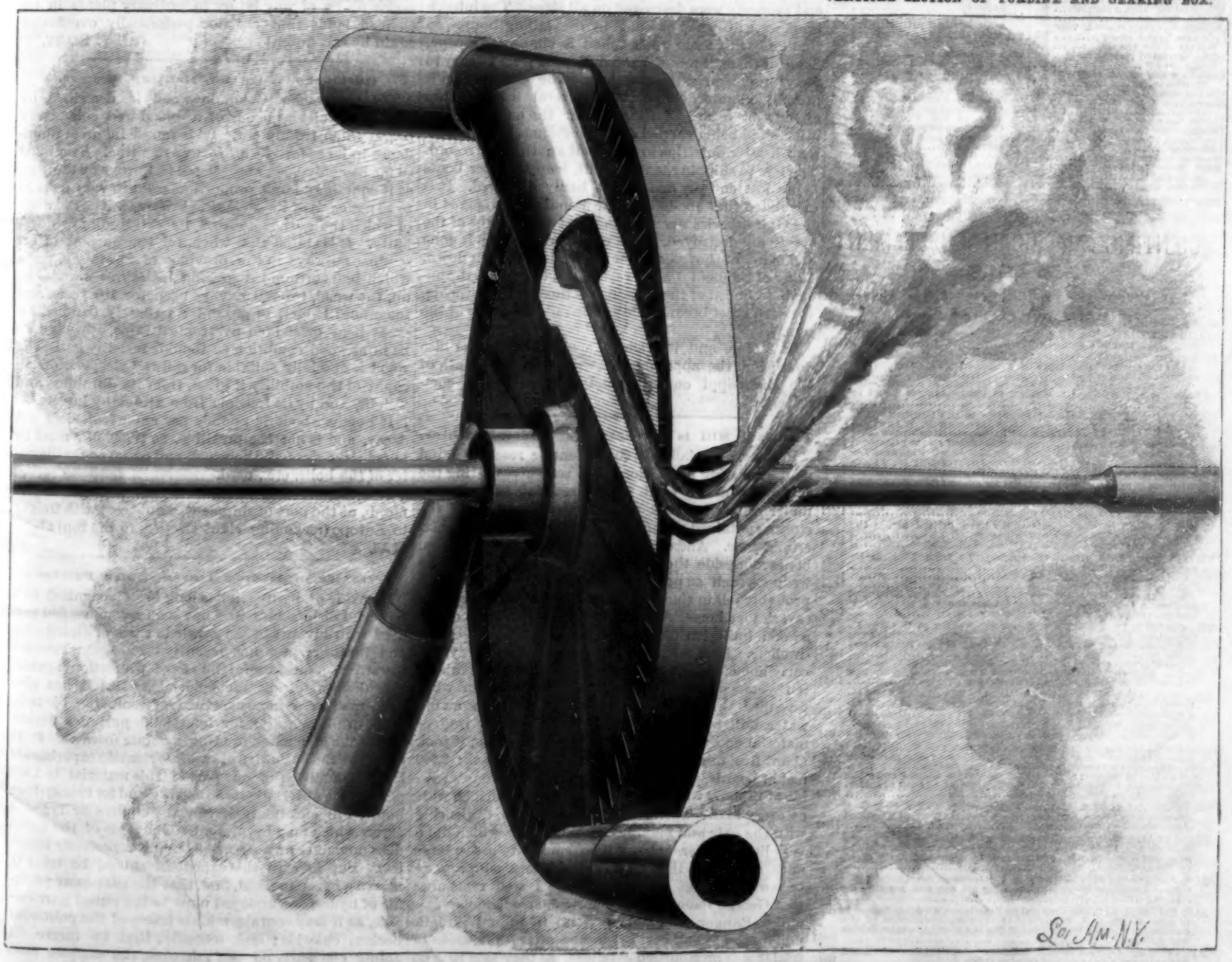

DE LAVAL'S STEAM TURBINE DEVELOPING A SPEED OF 20,000 REVOLUTIONS, 20 H. P.—(ACTUAL SIZE)—[See page 268.]

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NEW YORK, SATURDAY, OCTOBER 21, 1893.

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THE GREAT STORM OF OCTOBER 2.

On October 2 a great storm burst upon the northern coast of the Gulf of Mexico, coming without warning of any kind, although even if such warning had been given the loss of life and property would still have been very great. As it was, with the wind blowing upward of a hundred miles per hour and waves and backed-up water running 15 feet above the normal level, some 2,000 lives were lost, with millions of dollars worth of property. The storm came up from the Gulf, and the Signal Service officer at New Orleans had absolutely no warning of its approach. The telegraph line from Port Eads, whence the announcement of the storm should have come, broke down early on Sunday night as the storm came up.

The principal damage was done to the region about the mouth of the Mississippi, which includes islands and marshes all of very low level. One of the affected and typical regions, the St. Bernard or Lake Borgne Marsh, is a dead level ocean marsh, with more water than land, covering 1,200 square miles. It was inhabited by 200 fishermen, who lived in cabins built on piling. Chandeleur Island is another place where there was great loss of life, and is also typical of much of the adjoining region. This land rose but three or four feet above the level of the sea, so that in the storm it was completely submerged. Such places as this represent the entire region, which is a network of islands, bayous, lakes, and swamps, whose highest point is only about 7 feet above the normal sea level. The devastated area extends along the Mississippi from a point 46 miles from its mouth and runs east and west over an extent of over 100 miles. In most places the residents were white, of the most diversified classes, Italians, Spaniards, Creoles, and others. Besides these there were a Chinese and a Malay colony. The inhabitants were devoted entirely to the maritime industries, such as fishing and oystering. The Chinese were engaged in shipping shrimps to China.

The wind, blowing from the Gulf, forced the water back into the bayous and lakes, where it gradually rose and began to pour back into the Gulf and Mississippi over the intervening territory. Rain had fallen all Sunday, with a strong wind, and shortly after midnight the storm broke in its fury, the water rapidly rose, 9 feet of water poured over the levees, the low regions were swept by the sea and submerged many feet; houses were carried away by the wholesale and lives and property were destroyed on all sides. The inhabitants were drowned or killed by the falling houses, so that only the more robust had a chance to escape. Some of them, it was estimated, floated from twenty to forty hours on rafts and logs. The entire region is literally almost depopulated. Several instances are already on record of islands near the mouth of the Mississippi being carried away in storms, but the present disaster outstrips in its extent anything on record. The loss to shipping is very great, many smaller boats being lost entirely and others badly damaged. It is calculated that one-half of the population engaged in the Gulf fisheries are lost and that nine-tenths of the vessels are destroyed. Half of the orange crop is gone and many of the trees in the orchards are blown down. Many of the bodies were washed out to sea and the immediate burial of the remains of those left on the devastated coast became one of the sad necessities of the case.

In Mobile and its vicinity much damage was also done; but the appalling catastrophe at the mouth of the Mississippi outstrips and overshadows it completely.

The Saw Mill is Civilization's Pioneer Machine.

Professor Tyndall says that scientific researches find man wandering nude along the sea shores eating the raw oyster as he went, never dreaming that the tree under which he took shelter from the rigor of the storm contained elements that would warm his shivering frame. And again we find fragments of human bones alongside those of some wild beast, and stone weapons such as prehistoric man used, where the two probably fell in single combat for the possession of a cavern for a home. Here at our centennial is no doubt a good imitation of the ancient homes of these cave dwellers. I am now near my seventieth birthday, my early home being in the forests of Maine, and at about ten years of age did part of the work in what we called the thunder shower mill. It being an old water mill and an old gate saw made of iron or material not much better, sawing a long log, it took about five minutes to gig the old carriage back; 2,500 feet of boards, plank and timber was a fair day's sawing of 12 hours run. The saw cut fully 3/8 of an inch wide at every kerf. Then came the Mulay mill, dispensing with the gate and making quicker strokes, which did a very little better. Gangs then came into use in large mills, and it was then a good day's work with a gang to saw 10,000 feet of inch lumber. I well remember that George Page, of Baltimore, took a circular saw mill to Bangor, Me., and set it up in John Webster's mill on the Penobscot River, and after some weeks of trial it was pronounced a failure, as they said that no circular saw could be made to work in Maine timber. The fact was that they did not know then how to make a circular saw of any size large enough to saw mill logs.

At the centennial I saw one of the band sawmills, on the judges' day, saw of inch lumber, one log at the rate of ten thousand feet of lumber in one hour, and I saw it drop a board sixteen feet long every three seconds, and the saw cutting only a 1/8 inch kerf. I was told, however, that in regular work in the West 100,000 feet was often sawn inside of ten hours with a band sawmill. Whether this is to be excelled, we must leave the future to determine. J. E. EMERSON.

How to Get Rid of Salt in Land Reclaimed from the Sea.

Dr. C. V. Riley, of the Department of Agriculture, to whom we referred the above subject for information, writes as follows:

I received a note from you requesting an answer to a question asked by one of your subscribers, as to what process should be used to get rid of the salt in land that has been reclaimed from the sea and dried, and what plants can be set therein to the greatest advantage. The question cannot be intelligently answered without more detailed information as to the nature of the soil and the latitude. If the land is sandy, there is no better way than by leaching through irrigation, and the natural rains in time will do this, if there is good drainage. If the soil is tenacious, it will, however, be very difficult to get rid of the salt. The plants that would be recommended for a northern latitude would be different from those which might succeed in a more southern climate. There are certain grasses which thrive in salt lands, especially sandy lands; for example, the so-called black grasses, which make fairly good hay and are used for various other purposes. These are *Spartina juncea* and *Juncus gerardi*. Another grass which thrives in sandy soils and helps to prevent the sand from drifting is *Ammophila arundinacea*.

These will all grow in northern latitudes, and the salt marsh grasses, when they once get a good foothold, will thrive in such soil. The b arberries and the species of euonymus, especially *Euonymus japonica*, are known to thrive in salty lands. Of cultivated crops, the experience of the Mormons in Utah, near the Great Salt Lake, would indicate that beets, followed by potatoes, are among the most profitable crops in saline lands. It is questionable whether much salt long remains to be of any injury to ordinary plants in reclaimed lands that are not periodically overflowed again by salt water. C. V. RILEY.

Quebracho Wood for Railway Sleepers.

The Quebracho Colorado wood is described by Georges Poulet as being of a blood red color, very bright when freshly cut. It is found in great abundance in large forests in North Argentina. The wood so far has only been appreciated in Europe by tanners, as it contains a large proportion (said to vary from 15 to 20 per cent) of its weight in tannin, to the presence of which the author ascribes its extraordinary durability. It is stated that when, for the purpose of extending railways in the province of Santa Fe, posts which had surrounded grazing inclosures were taken up, the wood, though having been for 150 years, and sometimes longer, in ground alternately parched by great heat or sodden by tropical rains, appeared to be in as good condition as though recently cut. The wood is specially suitable for railway sleepers, on account of the stability it gives, from its durability and weight, and by its freedom from attack by insects.

It weighs about 78 pounds per cubic foot, does not decay, and is not compressible, so that holes must be bored clear through the wood, and equal to the diameter of the bolts, etc., used.

It is calculated by the author that a sawn sleeper, f. o. b. at the port of shipment, would cost with freight to Europe (reckoning eight sleepers to the ton) about $1.55.

Peroxide of Hydrogen as a Water Purifier.

Peroxide of hydrogen has long been recognized as a powerful disinfectant, and has been recommended and used with advantage as a gargle in cases of diphtheria, and in this respect has recently been again brought foward as a most useful means of protection against this disease during an epidemic. But it has also been used as a handy method of removing bacteria from drinking water for household purposes during outbreaks of cholera or other zymotic diseases. It is stated on the authority of careful scientific experiments that an addition of one part of this material to 1,000 parts of the water, when allowed to stand for twenty-four hours, will effectually destroy any cholera or typhoid germs which may be present. The taste of the water does not suffer any alteration, and it is perfectly harmless. But in case this expedient should be tried it must be borne in mind, first, that the particular peroxide of hydrogen employed must be the purest purchasable, as it may contain minute traces of the poisonous barium chloride; and, secondly, that to insure its acting efficiently on the microbes, the samples used must be freshly prepared.

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The World's Fair at Chicago is beginning to permeate the country. Its influence is steadily acquiring a momentum that is carrying to the remote limits of the States its wonderful character of beauty, and making the powerful stimulus of its invention, splendor and enterprise felt in our cities, and upon each one of us. Its pervasive loveliness, its beauty born of color and form, and around whose lineaments the radiance of light, shining with all the marvelous luxuriance of modern electrical design, has spent an aureole of surpassing joy, are moulding anew our requirements in art. As a factor of sensuous and almost ecstatic delight few fairs in the history of the world have approached it. As a revelation of the results that can be attained by the chaste and modulated combination of architecture and sculpture, at least in idea, perhaps none have equaled it; and as an example of the felicitious and almost ideal happiness of the union of structure with water surfaces it is unique. In this last particular the fair is a transfiguration. The exhilaration given by this combination of water and building are positively surprising. The picture it presents seems the evocation of genius, and hangs suspended in our minds a celestial vision. So complete is the mental satisfaction, so deep the draught of beauty, that the appreciative visitor for some hours lives simply in that sensation alone. To him the details of exhibition, the mass of material, the endless *facts* of progress, are offensive, and before he can recover his ordinary powers of inspection he allows the wonderful effect to subjugate and ravish him. The White City to him, for a while, is not a series of crowded storehouses, but an evanescent creation of poetry, that may pass with the motion of his hand or exhale with the shock of his breath. Not that it is fragile or capricious in effect; it possesses serenity and great grandeur, but it has so unusual and revealing a beauty that the spectator, feeling that he lives perhaps in commonplace surroundings, can scarcely transport himself to times of architectural wonderment without a feeling of distrust. He remains before it, quieted into a state of apprehension lest suddenly the picture will bodily rise and melt into insubstantial and trailing vapors, roseate perchance with the sun's last touch, but still only the mists of a surpassing dream.

Not the least remarkable indeed of the many aspects of the Fair is this buoyancy, lightness, and essential aerial mobility of the numerous and grandiose buildings. This impression becomes startling in some lights, as at evening. The whole marvelous creation dwells for a moment in a glory of rays as the sun sinks, and then becomes a perishing fabric, melting into the liquid sky, lost to the glistening eyes of men who watch its disappearance with a cry of despair.

As one awakes from this delicious excitement of amazement and pleasure, he begins to separate his impressions, and possibly one of his first inquiries will be, What adjustment of physical constants is it that leads to so admirable and graceful a result? In his analysis something like this must? I think, become apparent. The rudimental and dominating note in this architectural diapason is water. The buildings are tributary to that. Place these same superb creations upon a level plain, fill their interspaces with flowers, or shorn and gleaming lawns, throw around them a setting of woods, bring them under favoring conditions of light and shade, and yet no such illuminative effects would have been secured, no such transport of delicate elevation and serene majesty. The whole would have been listless and unresponsive to the craving of ideality. But this helpfulness of water, attaining a relation of ubiquitous importance to the buildings, has been wisely controlled. A large circular lake of water, around the borders of which the architectural displays would have been made, would not have brought together the reciprocal power of each upon the other. The water spaces are long and rather narrow lagoons or canals, along whose borders rise, in due proportion of height and width, and provided with subtle and expressive wealth of ornamentation, the royal structures whose characters enhance each other by their perspective contiguity, while they all derive more completely from the water, so arranged, the stimulation of reflections, which lighten and idealize all alike. A great space of water, over which they might have been seen, would have diminished them, broken down the architectural interdependence and dissipated beyond perception the host of fine effects that, with the changing conditions of the day and night, now provide the atmospheric feature which makes sometimes the aspect of the Fair grounds fairy-like and almost phantasmal. These effects, finally, have been deepened by the whiteness of the buildings. It was a fortunate decision, but one doubtless of no accidental nature—so just and masterly have been all the purposes of the great minds who have directed this enterprise—that the buildings are white. We all have noticed with pleasurable pride the pictorial distinction given to our cruisers by their white hulls, the scenic interest they gather from this color. So in the White City its color contributes essentially to the manifold variety of its bewilderingly beautiful effects.

The caressing shades seem to impart to the white figures, groups, and symbols that surmount the walls of the buildings, stand with astonishing impressive force upon the waterways, or confront you with splendid salutation upon the entrances, a half emphasized relief, and mingle over the convexities and concavities of the sculpture with an indecision of outline that makes the objects themselves unreal. Again, this whiteness permits sharp contrasts, and sometimes in the full sunlight produces a singular pallid brilliancy that defies words to define in its excessive mysterious beauty and beckoning power over the head and heart. As I stood before the Cattle Hall looking northward, with the stuccoed obelisk and its defiant lions at my side, the eye passed over water spaces, spanned by bridges bordered with white gray walls and here and there invaded by shrubby trees, and along facades, simple and effective, or elaborate and diversified, and rested at last at the end of the long avenue of forms upon the yellowed dome of the enormous Illinois building. The sky was darkened by some slowly gathering clouds behind it, but remained brilliantly blue above, and the picture was an incarnation of delicacy, poetry, and strength. Some notes of color are indeed permitted. The red green and yellow, in subdued tints, of the Transportation building and some monochromes among the State buildings perhaps heighten the white and *nivose* expression of the Fair. The one spot where a contrast in color seems the concentration of inspired design. It is where the colossus of Liberty rises in gold before the magical Peristyle. This beautiful colonnade, with the lines of speaking figures upon its parapet and the viewless spaces of the sky and Lake Michigan behind it, forms an admirable background to the august aud noble statue of Daniel Chester French. Looking from the Administration building past the sculptured energy and powerful symbolism of MacMonnies' Fountain up the Basin, with this glorious statue closing the vista in serious and stately splendor, the impression is overpowering. Here the effulgence of the robed and heraldic figure in the midst of the encircling whiteness stamps the whole picture with a magnificent distinction. It would be hard to conceive of anything more deeply satisfying and illustrative. The hands of the Republic are raised, in one she holds the world, in the other a staff surmounted by the Phrygian cap of liberty. She embodies the prophecy of the future, and seems in her conscious self-reliance, in the depth of restful composition with which she is moulded, to invite the world to follow where she leads. She is titanic in size, but no one thinks of it, or even suspects it, until dimensions of her unparalleled mass are read in the guide books. She belongs so exactly where she is placed, forms so aesthetically the crown, apex, and glorification of the beautiful buildings grouped about her, that the visitor worships her beauty and feels the thrill of her potent mute eloquence for the elevation and hopes of man.

The sculpture at the Fair, in the powerful groups upon the Basin, at the bases of the bridges, upon the sky line of the buildings, or placed like medallions of stupendous magnitude at the doorways of the Administration building, are fresh tokens of the stirring genius of American art. As we watch them in the light of the sun, beneath the shades of evening, or somberly shadowy above the frieze of electric lights at night, we recognize a strange power of expression in them. They are more than vigorous, different from being merely beautiful, finer than formal correctness, more noble than ornament. They speak a mute language of serious thoughts and deepen with their glorious effigies the impending sense of new eras, new conditions, new results, which the opening hours of the new century welcome and the closing years of the old century predict. A figure, yes many figures, on the Administration building and the Agricultural Hall, itself a wonderful conception, are in the spirit of Michel Angelo, and types of the most undaunted spirit, of the most free and aspiring and genuinely earnest intention in plastic art.

Much has been said as to the fairy-like effects of the electric lighting at night, when the great search lights throw their intense and colored floods of light, like shafts of glory, upon the great fountain, and when the jets of water rise in iridescent beauty, changing and mingling their color in bewildering profusion, and when along the surface of the water the myriad incandescent lights are blazing. This is all very fine, but no contemplative visitor can think of comparing such meretricious effects, with their simply showy and shallow accompaniments, to the studies of high and half lights which the great complex of buildings, with their numerous features, permits under the changing skies of day and evening. These seem most entrancing. Without entering the doorway of a single building, the intelligent understanding of and dutiful reverie upon this architectural display will reward the visitor. These are a few first impressions received upon the first day of the writer's visit to the Columbian Fair.

L. P. GRATACAP.

A New Yorker's Impressions.—Entering the Mining building at the center western entrance, the exhibits that strike the eye first are the gilded pyramids of wood, intended to represent the size and value of the amount of gold taken out in Germany, Russia, Australia or New South Wales in a given number of years, a very simple and effective way, much more easily comprehended by the observation than if stated in cold figures. There are immense blocks of coal to be seen, and a country showing the finest and richest display of all kinds of ores, silver, gold and others, is New South Wales. We have been told by one of its intelligent citizens, who visited the Fair, that the general public have no idea of the variety and value of its mineral wealth, which would yield fortunes to any enterprising Americans or others, should they undertake the development and marketing of such valuable deposits, with the economy of management and transportation prevailing in the United States. The display of ores, metals, etc., in this exhibit is remarkable, and there is a silver statue of Atlas.

Another striking exhibit is that of Montana, in which there is a silver statue of Justice (modeled after Ada Rehan, the actress), standing six feet high above the pedestal, and weighing 2½ tons. The remarkable displays of onyx, one a slab 7 feet 7 inches long and 2 feet wide, and the wonderful specimens of petrified wood from Arizona attract attention. In the foreign section is an interesting view of Carlsbad and its products; an ignot of nickel from Canada, weighing 4,500 pounds, valued at $2,250; statue of Liberty Enlightening the World, carved out of salt; a pillar of anthracite coal, 60 feet high, from Schuylkill County, Pa., representing the thickness of the great vein of coal found in that region.

The diamond exhibit in the Cape of Good Hope section is very interesting. There are photographs of the Kimberly mines, and also great blocks of the blue earth, as it is called, are shown, in which scattered among it the rough uncut diamonds run, at varying distances apart, just as they are found. Every afternoon the washing of the earth is shown and the exhibit is guarded by natives from South Africa. In connection with this exhibit is a separate room where men from Tiffany & Co. are engaged in cutting and polishing the diamonds, which is very interesting to see. The Brazilian mineral exhibit is very tastefully arranged and is filled with rare and costly stones.

Along the eastern half of the building are various kinds of mining machinery, including improved forms of stamp mills and smelting works. In this part of the building are also most of the exhibits of different States. A trip around the gallery of the building should not be overlooked. From this point a good general view of the rich exhibits displayed below is to be had. In the north end is a very complete display by the Standard Oil Company of their refineries, the extent of the oil-bearing regions, the different stages of oil refining, and the numerous large photographic transparencies hung in the north window of prominent wells and pumping stations. One of the largest transparencies ever made is shown. A raised map of the State of New York made on a proportionate scale is in the northeast gallery and is worth examining. In the west gallery are large collections of precious and rare stones, one collection by Tiffany & Co. being very complete. The attractive feature is a statue of "Silver Queen" from Aspen, Colorado, very tastefully arranged to illustrate the productiveness of that country as regards silver. Not far from this is a complete working model made to a scale showing the separation of metals from ores by means of lixiviation. In the east gallery there is a meteorite weighing 1,015 lb. which fell in Arizona. There is also an interesting exhibit of asbestos and its products. In displaying the great mineral resources of the United States the many exhibits are very instructive. Leaving the Mining building by the center eastern entrance a short walk leads one to the western center entrance of the Electricity building.

The impression one gets here is that there is considerable space for the exhibits, and after seeing the Machinery Hall exhibits there is much that is duplicated here. The numerous dynamos (many of them) are exhibited without being in operation. There are many forms of arc lights. The central pillar, composed of a thousand or more of Edison lamps in different colors, is very interesting at night, and is surmounted by a very powerful gigantic incandescent lamp. Another elaborate lighting exhibit is that of the Western Electric Company in the southeast corner of the building. By means of automatic switches and motors a series of

(*Continued on page 262.*)

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF OTIS C. WHITE, WORCESTER, MASS.

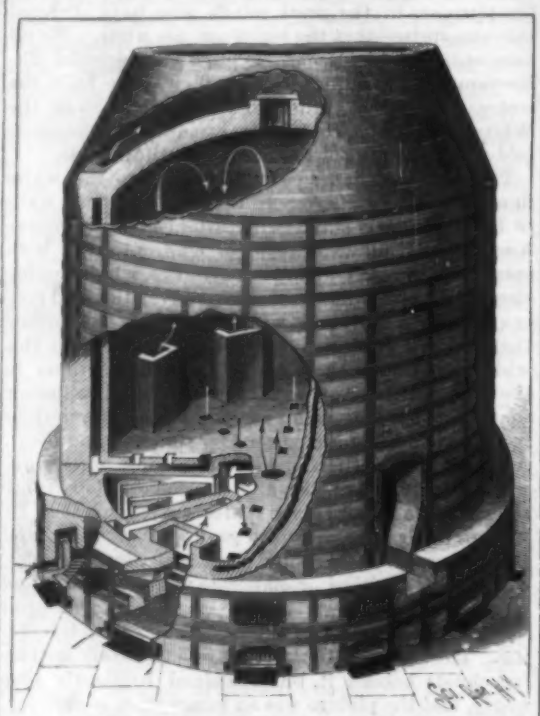
There are few if any single exhibits at the World's Columbian Exposition that seek recognition in more departments than that of adjustable extension movement in ball and socket and cone joints made by Otis C. White & Company, Worcester, Mass. The accompanying illustration shows this exhibit, which occupies a commanding position in the gallery in the Manufactures and Liberal Arts building. Although situated in this building, this exhibit comes in for consideration and award in the departments of machinery and electricity as well as liberal arts and manufactures. The various joints invented by Mr. White can be so combined as to be perfectly adapted to almost any line of work where joints are used, from the delicate adjustments required in scientific work to such coarser uses as the holding of the heaviest vises at an angle. A great variety of applications is included in the exhibit: forms used by surgeons, microscopists, biologists and photographers, as well as by artisans of every sort. The joints have as their bases a divided ball and socket joint, which is most ingenious and novel, and has of course been carefully protected by patents in various countries. A most valuable feature is that either a firm unyielding grip can be arranged for, or more or less elasticity can be introduced and controlled, so as to allow motion under any desired amount of pressure. This elastic quality has made feasible the novel series of adjustable holders for electric lights, which have attracted the attention of practical men to the exhibit. The illustration shows in the doorway one form of these holders, which has a ball and socket joint at the base, a sliding swivel joint at the elbows, and a wrist joint just back of the lamp. The swivel joint allows both rotation and extension to full length of each arm; and while all these adjustments can be easily made by the hand, the position is afterward retained, without any attention to screws or fastenings of any sort. The lamp can be moved, therefore, to any point within the radius of the arms, and there it will steadily remain, as long as it is wanted. This invention for the first time makes it possible to carry the incandescent lamp exactly to the work. A further and most important merit of these joints will appear on close scrutiny. The parts are all so devised that they can be made in quantities easily and cheaply, and can be put together by ordinary skill, so that the complete holder can be sold at a price which is surprisingly low.

Up to the present time the owners have been so busy in perfecting the joints and the processes of manufacture that no effort has been made to introduce the holders; but they have been sought by manufacturers, and are now in daily use in many large shops and factories. As soon as the inevitable corporation is completed, there will be little delay in supplying the largest and most varied demand.

THE H. K. Porter & Company, of Pittsburg, Pa., builders of light locomotives, have received an award for all of the locomotives shown by them at the World's Fair, including both the "Logger," exhibited in connection with the Forestry department, and the other four motors and locomotives exhibited in the Transportation building. These interesting exhibits were fully described in the SCIENTIFIC AMERICAN of October 7.

LAWTON'S IMPROVED POTTERY KILN.

The economical use of fuel in the larger class of furnaces, such as those used for glass or pottery, is one of the most important problems of the day. In the cut we illustrate the Lawton pottery kiln, in which a partially regenerative or recuperative effect is obtained, with accompanying economy of fuel. The kiln is of the cupola shape, with furnaces distributed around its base which are of improved form. The air for the final combustion of the smoke and gaseous products passes through flues on each side of the furnaces and enters the fire chamber highly heated. This insures economy of fuel and also perfect combustion, little or no smoke being produced even with bituminous coal. The products of combustion from the furnaces are distributed by flues beneath the floor of the kiln. One portion goes to a central orifice, recognizable in the cut by arrows issuing from it, and another portion to a number of flues rising within the kiln and lying against its inner wall and opening into its interior. The kiln has a dome-shaped roof. Against this the currents of the gaseous products of combustion strike and are deflected toward the floor. The kiln is surrounded by an annular chamber connected to the interior by a number of flues under the floor leading to holes or apertures. In the cut these holes are shown of square shape. The deflected gases pass out through the apertures and flues leading from them and fill the annular space as they escape to the chimney. Thus the thin wall which serves as lining to the kiln is kept hot by what would otherwise be the waste heat of the furnace.



LAWTON'S IMPROVED POTTERY KILN.

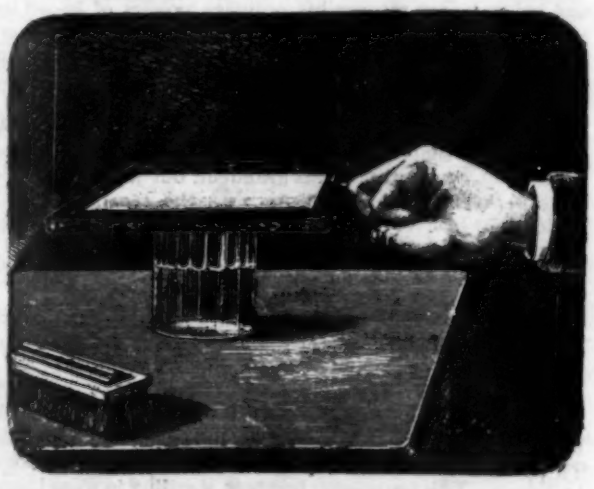
In the center of the inner dome one or more crown holes are provided, which are opened when the kiln is being burned off. This facilitates cooling. A short movable pipe may also be placed over the central floor aperture to accelerate the starting of the fire and to regulate the inner currents. In use the chamber is filled with pottery and the fire started as usual. Owing to the heating of the air supply, the furnace is filled with so pure an atmosphere that the most delicate ware is unimpaired in color. The construction favors even distribution of heat also, and attains its results by a comparatively simple construction requiring no deep excavation. The air, which is gradually heated and introduced through the ports in arch and ends of the furnace, provides a very perfect combustion, and by means of this construction the dangerous gases which often do so much mischief are destroyed, and also the smoke, even when bituminous coal is used.

Full particulars may be obtained from the inventor, Mr. Lewis Lawton, Trenton, N. J.

A SIMPLE ELECTRICAL MACHINE.

That yellow amber, when rubbed, acquires the property of attracting light objects was known as long as forty centuries ago. This first experiment in electricity was destined for a splendid future, but a distant one, since it is from yesterday only that date the truly serious applications of this science.

We shall now endeavor to show how the fundamental experiments of electricity may be performed with as reduced a material as possible. A sheet of paper will suffice us in the first place for a few interesting experiments. Heat a piece of ordinary paper in front of a brisk fire or over a lamp chimney until it begins to redden. Afterward rub it smartly with the hand or, better, with a brush, and it will then be capable of attracting small, light objects, such as fragments of thin paper and the web of feathers. If the sheet of paper be brought near a wall, table or any stationary object whatever it will be strongly attracted. Finally, if one places it above his head his hair will be attracted, while at the same time he will experience a sensation comparable to a slight tickling.



A SIMPLE ELECTRICAL MACHINE.

But more remarkable results still are reached upon improving the apparatus. Take a glass, expose it to the fire so that it shall be perfectly dry, and place it upside down upon a table. Afterward take a tray, perfectly dry, and place it upon the glass in such a way that it shall preserve its equilibrium. Finally, take a sheet of paper slightly smaller than the tray, heat it and rub it rapidly with a brush and it will become quickly electrified. Then place it upon the tray.

An electrical machine will thus have been constructed without any expense. If the finger be brought near the tray, a spark will appear. This spark will be so much the brighter and the series of sparks will be so much the longer in proportion as the glass and tray are drier.

If, while the sparks are being drawn from the tray, the room in which the experiment is performed be darkened, these sparks will appear extremely brilliant. —*Science Illustré.*

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF OTIS C. WHITE, WORCESTER, MASS.

Remedy for Color Blindness.

According to the *Med. Record*, Dr. A. E. Wright states it to be a fact that total color blindness is very rare; also, that yellow-blue color blindness is very rare. The common form is the green-red blindness. It so happens that in the establishment of signals, green and red lights form the most commonly used colors, hence, from three to five per cent of men capable of doing work as pilots or engineers are kept out of such employments, often with results that are almost cruel. Most color-blind men can readily distinguish yellows and blues, and the doctor proposes that the red lights should have a distinctly yellowish tinge and the green lights a distinctly bluish tinge. In this way the difference between signals could be readily made out by almost all the color blind.

Torpedo Boats for Men-of-War.

Considerable interest is being taken in the new torpedo boats which are now being constructed, two at the New York navy yard for the Maine and two others at the Norfolk navy yard for the Texas. The boats are built as light as possible, so that they can be easily hoisted on board the large vessels. The torpedo boats will be operated entirely from the men-of-war as regards supplies, only a ton of coal at most being carried. The general dimensions of the boats are as follows:

	Maine. Ft.	In.	Texas. Ft.	In.
Length over all	61	8	50	0
Length on load water line	58	6	48	1½
Beam at water line	9	0⅞	9	0⅞
Freeboard	2	5	2	3¼
Mean draught	2	2	2	1½
Extreme draught	3	3	3	4

The Maine's boats will have a displacement of 14·8 tons each and the Texas' 12·15 tons each.

The two boats for the Maine will each be fitted with a bow tube for discharging an 18 inch Whitehead torpedo and the two boats for the Texas will each be fitted with a deck training tube for a torpedo of the same size. Each boat will carry a 1-pounder rapid-fire gun. The engines are single vertical quadruple expansion, working at a pressure of 250 pounds. The torpedo boats will be driven at a high rate of speed. It is expected that the torpedo boats for the Maine will make 18 knots and those for the Texas 17 knots per hour. The Whitehead torpedoes weigh 875 pounds, with tube and launching gear a little over half a ton, so that a great deal of attention has been given to the question of stability. This weight being considerably above the water line, the other weights, such as the engine, boiler, fuel, etc., are so arranged that the center of gravity is as low as possible.

The results of calculations for stability are as follows: At nominal condition, ready for service, with ammunition, torpedo, and crew of five men on board:

	Maine.	Texas.
Metacentric height (feet)	1·55	1·5
Angle of heel at maximum stability (degrees)	43	38
Righting moment at maximum stability (ft. lb.)	27,135	16,308
Angle of vanishing stability (degrees)	82	73

With thirty men on deck, in addition to weight at normal condition:

	Maine.	Texas.
Metacentric height (feet)	0·83	1
Angle of heel at maximum stability (degrees)	35	30
Righting moment at maximum stability (ft. lb.)	18,400	7,875
Angle of vanishing stability (degrees)	67½	52½

Cockpits, with considerable seating capacity, have been provided, so that the torpedo boats may be used as dispatch boats if necessary.

SCULPTURE AT THE WORLD'S FAIR.

When the ephemeral glories of the Chicago World's Fair have passed away, the best of the statuary will remain a lasting memento of 1492–1892. One of the finest pieces of sculpture is illustrated on this page a group of horses drawing a chariot in which stands the triumphant Columbus with heralds on either side, surmounts the Peristyle; another is a group from the Agricultural building. Both are the work of Mr. Edward C. Potter and Mr. Daniel C. French, and are worthy of the subject and the occasion.—*Black and White* (*English*).

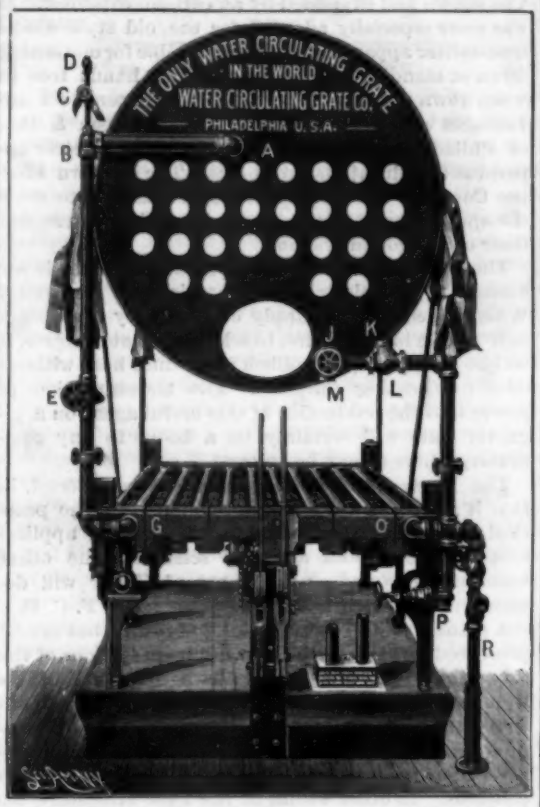
SCULPTURE AT THE WORLD'S FAIR—STATUE OF COLUMBUS ON THE PERISTYLE.

Launch of a Great Cargo Steamer.

The new White Star Liner Cevic recently launched is a very fine vessel, 500 feet long, 60 feet broad, and 38 feet deep, of a registered tonnage 8,315. Her total capacity of hold is 14 089 tons. She will be provided with accommodation for 800 head of cattle on upper decks, with permanent stalls for twenty horses in the center, besides having room in holds for a big cargo of other freight. The Cevic is built of steel throughout to Lloyd's highest class, and will be propelled by two screws with manganese bronze blades, driven by two complete sets of triple expansion engines. She will be lighted throughout by electricity. The scheme for ventilation on board will be as near completeness as possible. The Cevic has been built by Harland & Wolff for the White Star Line for carrying cargo and live stock between New York and Liverpool.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE WATER CIRCULATING GRATE COMPANY.

The exhibit of the Regan water circulating and shaking grate is located in the boiler house extension, Section D, Machinery Hall. This grate is designed for marine, stationary and locomotive boilers, and is adapted for all classes of fuel without change of bars.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE WATER CIRCULATING GRATE COMPANY.

No artificial draught is required, and the circulation is designed to keep the boilers clean. The operation of the grate is as follows:

R is the feed pipe; O is where the water enters the grate from the feed; M is a valve to shut off blowing surface blow; L is a reversed check which closes when feeding, and supplies the grate with water; J and K are the connections which go through the boiler front and connect on to the bottom of the boiler; G is where the feed water comes out of the grate on its way to the boiler; E is a valve which is to be shut when blowing from the bottom; A is where the water is delivered into the boiler, through an inside pipe, nine feet in length; B, C and D is an air check which allows the air to escape from the grate when building a fresh fire; P is a blow-off from the top and bottom of boiler, including the grate. One lever shakes the front half and the other lever the back half of the grate. There are stops on these levers, allowing the fire to be shaken little or much, as desired. When starting to feed at R, the water goes up the pipe to L, the check shuts and prevents the water from going into the bottom of boiler at J, and backs down to O, and enters the grate, running through one bar and then another, coming out at G; it then passes up the pipe to A, and enters the boiler at the top under the water line, through an inside pipe which carries the water and delivers it at about the middle of the boiler. The moment feeding stops, the check, L, is opened from the pressure from boiler, and the water from bottom of boiler takes the place of the feed which is cut off. To blow the grate, open P and shut M; this gives a surface blow from the top of boiler, passing through the grate, keeping it clean of all sediment; as soon as the surface blow has been used enough, let P remain open and open M; now the blowing is at the top and bottom at the same time; the bottom one is sucking the mud from bottom of boiler; shut P, and circulation commences at once. *M and E always remain open unless blowing, as they are the two main lines of circulation from grate to boiler.*

This grate is made by the Water Circulating Grate Company No. 1028 Filbert St., Philadelphia, Pa. It has been patented in England, France, Germany, Austria, Spain, Belgium, and Italy, as well as in the United States.

Completion of the Mont Blanc Observatory.

The observatory on the top of Mont Blanc is at last completed. The work was facilitated by the use of windlasses, which drew the materials up the icy slopes. Some of the builders remained on the summit for twenty days, the August weather being very favorable. The construction of the observatory was begun over two years ago. The builders hoped to cut through the ice cap to solid rock, but this was found to be impossible, after they had gone down a distance of thirty or forty feet. So at last it was determined to let the building stand upon the ice and snow. The observatory was made in sections at Paris, under the immediate direction of Mr. Janssen. The pieces were transported to Rochers-Rouges on the backs of men, and were finally brought to the summit by the aid of windlasses. The building is thirty-eight feet high, but only one-third is above the snow. The upper story is used exclusively for observatory purposes, while the lower stories shelter attendants and parties of tourists. The observatory rests on ten heavy screws, so that the building can be easily leveled. The interior is lighted by small dormer windows with double panes of thick glass. All wood used in the construction is fireproofed, and all necessary precautions against fire have been taken. Anthracite coal will be burned. It is seldom that the cold exceeds thirty-two degrees below zero. The observatory will be occupied from May to November, and a great deal is expected from the self-registering instruments during the winter. If possible, it is intended to connect the instruments with Chamounix by electricity, but no steps toward this end have been taken yet. M. Janssen was carried to the top of Mont Blanc last year in a litter borne by thirteen porters. The new observatory will enable scientists to carry out important experiments and observations in physics, meteorology, spectrum analysis and vegetable and animal physiology.

Phosphorescent Minerals.

Mr. Jacksh, of Trieste, Moravia, as quoted by the *Popular Science Monthly*, names four sulphurets which become phosphorescent after a brief exposure to daylight—the sulphurets of calcium, strontium, barium and zinc. The last compound has been obtained in a luminous condition only recently by distillation in a vacuum. Prepared in the usual way, by precipitating soluble salts of zinc with sulphurets, it shows no signs of phosphorescence. Sulphuret of barium gives a yellowish orange glow, but only for a few minutes after each exposure to the light, and is of as little use as the sulphurets of strontium and of zinc, the greenish glow of which disappears after about two hours. For practical uses the sulphuret of calcium of commerce is the only phosphorescent of value. Pure, it gives a faint yellowish light, but treated at a red heat, with the addition of a small quantity of a salt of bismuth, it is transformed into a substance giving a violet light and retaining its luminous quality for nearly forty hours after an exposure of only a few seconds.

Notes from the World's Columbian Exposition.

(*Continued from page 259.*)

incandescent lamps in red, white, and blue colors are arranged in zigzag radiating lines from a common center at the top of a column of lamps about 20 feet above the floor and parallel with it, their outer ends terminating in rotating globes about 3 feet in diameter, also composed of many red, white, and blue lamps. The current is first passed from the bottom of the column upward and then follows the zigzag lines to the rotating globes, illuminating them for a minute. As it passes along, the several lamps, or groups of them, are successively lighted, which produces a very curious effect. They also exhibit a row of lamps put in the form of a sign or name, and exhibit their automatic device for closing the circuit on this in such a way as to progressively illuminate each letter of the name until the whole is spelled out. Then the whole is extinguished and is rewritten again, as one might say, in electric fire. It is a very curious and novel electric device, and attracts many visitors. The north end of the building, on the ground floor, contains exhibits by foreign countries, including Germany, who sends some massive dynamos and arc lamps and exhibits a historical collection of Siemens' inventions and many forms of devices for measuring the electric current and the testing of lines.

The northeast corner contains full sized models of delicate instruments from Japan, used in determining the extent and duration of earth vibrations in earthquakes. At the front or south end of the building is a large structure, built in Corinthian style of architecture, containing the fine exhibits of the American Bell Telephone Company. The World's Fair telephone exchange is shown in full operation, and the modern switchboard and devices for facilitating connections, together with long distance machines, are exhibited in very complete shape. In one room visitors have the privilege of hearing a concert going on at the Midway Plaisance every afternoon, and in another music played in New York was distinctly heard, as well as conversation with that city. The evolution of the telephone is also shown by many models and drawings. It is a most instructive exhibit, and is worthy of a careful examination by visitors.

In the east gallery, up stairs, are many German and Austrian exhibits of optical instruments that could not be placed in the Liberal Arts building for lack of room. Among them were noticed the fine microscope and objectives by Zeiss and specimens of the celebrated Jena optical glass, made by Herr Schott & Co., so white and transparent that when looked through edgewise it is perfectly colorless.

Adjoining a restaurant, in the north end of the gallery, is a pavilion, from which a magnificent view looking north over the Wooded Island is to be had, and it should not be missed. Located near by are examples of electric burglar and fire alarm apparatus and a complete exhibit by the Gamewell Company, a model of an automatic electric railway switch and signaling device, and along the western gallery is a novel machine worked by electricity for cutting several thickness of cloth at once. The modern rapid automatic system of transmitting cable messages is shown to perfection by the beautiful exhibit of the Mackay-Bennett Company. A resistance cable is shown, having a similar resistance to that of the cable across the Atlantic Ocean.

The sending and receiving instruments are shown side by side. To avoid every element of danger of error, the message is first punctured out on a strip of paper by a special machine and then run through the sending instrument; the receiving instrument is what is known as the siphon recorder. It has a hair-like tube of glass which siphons the ink from the reservoir and makes a mark on a strip of paper in zigzag lines across a straight continuous center line. The motion is imparted to this siphon needle pen by the varying movement of the galvanometer receiving instrument. There is scarcely any friction, and as a consequence the message is received very accurately. The attendant told visitors that the old fashioned way of reading messages by the projection of a vertical line of light upon a graduated white screen was probably fifty times slower than the present method, while this had the merit of also recording the message in ink.

Near this exhibit is that of Gray's tele-autograph machine. It is very simple and interesting, and was illustrated in the SCIENTIFIC AMERICAN a short time ago. Two machines are shown working in unison. The operator has a pencil having elastic bands attached near the point to steady the motion, and as it moves over the tablet, the distant pencil also moves and makes the copy exact. It is an instrument which has a promising future.

In the southern end of the gallery are Edison's phonograph exhibits and his latest invention, the "kinetograph." He photographs the face at the same time one talks into the phonograph. By this method the sound and the motion, of the lips in producing it are accurately reproduced. There is in the gallery also the wonderful German clock and a model of an electric ball and signal tower. The Edison-Lalande single solution non-polarizing battery is a noticeable exhibit, the intensity and steadiness of the current being one of its special features. Three cells will run an electric fan for a great number of hours at a very small cost.

A convenient attachment for holding the telephone to the ear combined with an adjustable writing tablet was shown and explained by an earnest exhibitor. It was more especially adapted for the old style Blake transmitter apparatus, and is adjustable for one sitting down or standing. It leaves the two hands free to write down messages. For business concerns its advantages were very manifest. Messrs. Queen & Co., of Philadelphia, have a fine display of electric apparatus for educational purposes. The Western Electric Company have a separate room fitted up to show the application of electric lamps in scenic theaters, and their underground system.

The utility of electricity as a heating medium is exhibited in the electric stoves, which are a novelty. When the cost of the supply of electricity is reduced, as it will be in the future, to a level of that of steam, it will be a very simple problem to produce heat without odor for heating purposes. The transmutation of power into the production of this useful agent on a gigantic scale will certainly be a boom to any community where it may be enjoyed.

The Electricity building has a special interest, in that it represents the latest developments of the practical usefulness of electricity in its manifold applications in the various arts and sciences. The other buildings surrounding the Court of Honor will demand further attention. F. C. B.

A glance at the list of cities and towns that are represented by exhibits in the American sections of the several buildings shows that Chicago leads all others by a long distance. In the Manufactures and Liberal Arts building the American section occupies about one-quarter of the entire space in the building, and one-seventh of the exhibitors in this space are Chicago concerns. In other words, of the 1,400 exhibitors, 200 are from Chicago. In the division of paints and varnishes nearly one-half the exhibits are made by Chicago houses, while in the stained glass division over one-half are from Chicago. Nineteen Chicago concerns are represented in the division of stoves and heating apparatus. In the Transportation building nearly one-third of the space in the American section is occupied by exhibits from Chicago, while in the Agricultural building the Chicago exhibits of food stuffs, provisions, and agricultural machinery form a large part of the display.

Missouri Mineral Exhibits.—The chief ore of zinc occurring in Missouri is the sulphide, ZnS, known as sphalerite or blende, but called "jack" by the miners and "black," "rosin" or "steel jack" according to its color. Almost all of this ore comes from strata of lower carboniferous age in Jasper, Newton and Lawrence Counties in the extreme southwestern part of the State, a region which is continuous with the zinc and lead region of southeastern Kansas. Less important quantities of sphalerite are produced in Greene, Morgan, Washington, and other counties. The exhibit contains beautiful cabinet specimens as well as massive commercial ore, and the variety of color and crystalline form is very interesting. One of the exhibits is a huge mass of almost pure "rosin jack" weighing 1,650 pounds from N. Perry's land at Carterville. Resting on a pedestal of Missouri spelter is a 790 pound mass, consisting for the most part of huge crystals of "black jack" dotted over with very small crystals of dog tooth spar and octahedral crystals of galenite, which comes from the Empire Zinc Company, Joplin.

An instructive feature of the exhibit of sphalerite is the display of the mill work of the Empire Zinc Company on the ore from its Kohinoor mine. Twenty-one jars show the ore as it comes from the crusher, as it is fed to each size jig and the slime tables, and the "heads" or concentrates and the "tails" or refuse from each. The average amount of zinc in the concentrates of this company is about 64 per cent, that in the tailings is about 2 per cent, while that in the rock crushed is about 18½ per cent.

Almost the sole lead ore is the sulphide, PbS, or galenite, which the miners name "lead."

The lead ore of the southwestern district is readily cleaned by hand picking or jigging, but that of the southeastern region is so intimately mixed with the rock that an elaborate plant is needed for its proper concentration. Such a plant is illustrated in the exhibit by a beautiful model ($\frac{1}{12}$ actual size) of the ore-dressing works at Bonne Terre, owned and operated by the St. Joseph Lead Company. The mill handles from 900 to 1,000 tons of rock every twenty-four hours, and each crusher feeds its own set of roughing jigs, sand jigs and percussion slime tables, so that in case of a breakdown it is not necessary to stop the whole mill, but only that series in which the accident occurs. All the crushers, jigs and slime tables are on the main floor of the mill, while the rolls, screens, pumps for the elevation of material, classifiers and settling vats are on the floor beneath, and everything is arranged to work as automatically and with as little manual labor as possible. In addition to this model, the exhibit of this company consists of a series of specimens and samples, showing very fully the country rock and the occurrence of the ore in it, the milling products and the various stages of furnace work to commercial lead. In addition to these is a set of large photographs of the mills, furnaces, etc., belonging to the company. The St. Joseph Lead Company's mines at Bonne Terre are the largest in the two Americas and the third largest in the world.

The finest specimens of crystallized galenite in the exhibit come from the land of the Oswego Mining Company, of Joplin. This is a very large group of almost perfect crystals, some of which are fully three inches on the edge.

The Picher Lead Company, of Joplin, makes a unique display of a comparatively new industry, viz., the manufacture of strictly amorphous lead sulphate for paint. This is made directly from galenite by the Lewis-Bartlett process as a by-product in the making of pig lead. The process consists in catching in tow bags the volatilized lead sulphide given off by the open Scottish hearth furnaces; burning the sublimed sulphide in the open air; completing the oxidation to sulphate in a furnace, and purifying the sublimed product. The display consists of crude ore and slag and grades "A" and "AA" of "sublimed white lead," which contain small percentages of PbO, and "sublimed lead sulphate," which is more than 99 per cent pure $PbSO_4$. The firm marketed more than 5,000 tons of these products in 1892.

Nearly in the center of the exhibit stands a pyramid ten feet high made up of huge masses of lead and zinc ores aggregating 28,000 pounds, which represents the output of the whole State for fourteen minutes of working time in 1892. The most striking specimens in the pile are a mass of pure galenite from Belleville, Jasper County, weighing 6,500 pounds, and one of rich disseminated galenite weighing more than 5,000 pounds from Bonne Terre. A pile of pig zinc ("spelter") containing 200 slabs and weighing 9,600 pounds, represents the amount of metal in the zinc ore mined in the State every fifteen minutes of working time in 1892; and a pile of 70 pigs, or 5,600 pounds of lead, represents the same for that metal. The product of the State for the fiscal year ending June 30, 1892, was 131,500 tons of zinc ore and 32,000 tons pig lead.

The chief mineral associate of the lead and zinc in Missouri is calcite, and this is shown in the exhibit in wonderful variety, beauty, and complexity of form. The largest single crystal is a doubly-terminated acute scalenohedron, measuring more than two feet from tip to tip. It is from Joplin. Other important associates are dolomite, marcasite, or "white iron pyrites," and barite, all of which are well represented in the exhibit.

The Iron Mountain Company, which owns and operates the mines at the world famous Iron Mountain, in St. Francois County, makes a complete exhibit of all the grades of bessemer and non bessemer specular iron ore which it produces, and specimens of the associated rocks and minerals, together with charts and photographs of the mines, mills, and surrounding country, and an interesting and instructive dissected model of the mountain. More than 3,500,000 tons of specular ore and low grade hematites and limonites show the wide distribution of iron ores throughout the State.

The building stones of the State are numerous and beautiful, and are represented in the exhibit by dressed cubes. Red and gray granite from St. Francois and Iron Counties; light gray crystalline magnesian limestone from Greenfield and Carthage; white non-magnesian limestone from Hannibal; gray, red, cream-colored and mottled marbles from near Fredericktown, Madison County; drab sandstone from Warrensburg; and yellow sandstone from Ste. Genevieve, indicate the extent and variety of Missouri building stones. "Mexican onyx" occurs in many parts of the State, and some fair samples are on exhibition.

Fine kaolin or china clay, ball clays, potters' clays, fire clays, terra cotta clays, and brick clays occur in many localities in the State, and a fully representative collection is displayed in the exhibit.

A fine lump of cannel coal 5½ feet high from a bed 68 feet thick in a "pocket" in Morgan County is the chief feature of Missouri's coal display. More than $6,000,000 worth (mine value), almost all of which was bituminous, was mined in 1892.

One of the main features of the exhibit is a relief map of the State, which was constructed especially for it, and is about six feet square. E. O. HOVEY.

No words can describe the enthusiasm with which Chicago people celebrated Chicago day, October 9, at the Exposition. Business was never more universally suspended throughout the city than on that day, and nearly every merchant and manufacturer bought souvenir Chicago day tickets, many by the hundreds, according to the number of employes, to distribute among them. The weather was perfect, and the number of strangers in the city was much in excess of anything yet experienced since the Exposition was an as-

sured fact in this city. Trains that ordinarily came into the city in perhaps two sections came in divisions with several sections in each division. Saturday 100,000 extra visitors must have come to the city, and on Sunday at least as many more arrived. Meantime the citizens had prepared a welcome by decorating the leading buildings in the business center. On Sunday there was the largest attendance within the grounds of any Sunday by nearly double, the number of paid admissions being 88,000, but there were no indications in the grounds of the great day to come. The only thing unusual about the park was the crowds. Crowds were everywhere, and many people were not fortunate enough to even secure a cot or a table to sleep on. In places down town many people are reported to have paid a dollar for the privilege of having a chair to sit in all night.

Monday the gates at the Exposition grounds were thrown open at six o'clock, although heretofore eight o'clock has been the hour of opening. Even this hour was not too early for many of the new comers who were seeing the Exposition for the first time. An important feature of the attendance was the number of Chicago citizens who purchased tickets, went to the grounds and entered the gates so their presence should be recorded, then immediately turned about and returned home. Chicago pride was the main incentive for this, so that the day should be the high tide mark in attendance, but another consideration was that this day, the twenty-second anniversary of the great fire which laid almost the entire city in ashes, should be a memorable one, so far as its observance was concerned.

Then, again, a large attendance guaranteed a sufficient sum in the treasury to pay off all obligations and leave the Exposition free from debt.

The formal exercises of the day began at ten o'clock, and some of the important features of the programme were: a fanfare of universal peace by eight buglers from the regular army, who were stationed at different points about the basin, and sounded the notes of peace; a chorus of eight hundred voices, that sang the national hymns of the countries of Europe and the most popular of standard American tunes; the ringing of the Liberty bell; and representation of the different States of the nation by school children. The great event was the parade of floats, which took place at sundown. This was followed by a grand display of fireworks, the leading figure being a representation of the burning of Chicago, covering 14,000 feet of space, and representing four scenes, the O'Leary cow, the cow kicking over the lamp, the fire starting and sweeping everything before it, and the city in ruins.

The Liberty bell was rung by a rope composed of contributions of fiber of all kinds from all corners of the earth, and comprising all kinds of vegetable and animal fibers, from hemp and manila to silk and scalp locks and braids of hair from Indians. Two old fire engines, survivors of the great conflagration, were conspicuous reminders of the event the celebration commemorated. Pokagon, a son of the Indian who sold the site of Chicago to the whites for three cents an acre, was conspicuous among the special guests of the day and made an address, and John Young, a son of the Pottawatomie Indian from whom Chicago was named, was also present. The original treaty granting the land to the whites, which has been carefully preserved to this day, was one of the precious relics of the day that was exhibited.

On the following morning the official announcement of the previous day's attendance was 713,646 in paid admissions, 682,587 full admissions and 31,059 children, while the 37,390 passes swelled the total attendance to 751,026. The crowds were handled with remarkable success, but the numbers were too great, and premiums were paid even for a foothold on street cars, and many men clambered to the roofs of the cars, a sight that has not been seen in Chicago for many years.

The number of paid admissions from May 1 to October 12 amounted to 16,803,955. The attendance on Chicago day (October 10) being 703,021. The attendance at the greatest day in Paris, 1889, was only 397,150.

The New York Pasteur Institute.

The new building of the New York Pasteur Institute, West Central Park and Ninety-seventh Street, was formally opened October 9, the inaugural address being delivered by Dr. Paul Gibier, the director of the institute, who is one of the most distinguished pupils of Pasteur. For several years the Pasteur Institute was maintained at almost the sole charge of Dr. Gibier, who has an extensive practice among the Franco-American population of New York. At length a subscription was raised and the present fine building erected. The institute is five stories high and is built of brick and stone. The building is constructed on scientific principles and all the latest improvements introduced in the laboratories of Pasteur, Charcot and Brown-Sequard have been adopted here. Bedrooms for patients who pay and for those who are treated gratuitously are provided in sufficient number to accommodate the maximum number of patients who have already been treated at one time. On the roof are rooms built of asphalt, to contain the rabbits and other animals used in experiments. Various medicinal baths are also provided. Dr. Gibier came to the United States in 1888 to study yellow fever. In New York the following year it was proposed to him to establish an anti-rabic and bacteriologic institute, and the present fine building is a just recognition of the value of his labors.

A NEW STEAM TURBINE.

Steam has been found to be the medium best adapted for converting heat into mechanical work; its low price, simple means of production, good chemical qualities, the ease with which it is reduced to a liquid state and the comparatively small dimensions of the appliances needed, have caused its decided preference to other gases. During several generations work has been progressing in all civilized countries for the development of the steam engine; and yet invention in this field is far from having reached perfection. Each year the consumption of steam per horse power is reduced by a fraction; each new number of the technical journals brings information of new and improved constructions of steam engines. Every constructor of engines knows that here is a vast field for the persevering work of man. To this the results of the last decade bear testimony.

Concerning the theoretical conditions for a favorable conversion of heat into mechanical work, viz., high initial temperature and high pressure, the possibilities of their being accomplished in the steam engine are very limited. The strength of the boilers is even now put to severe tests by the high pressure, and the sensitive parts of the engine cannot endure the high temperatures which might be desirable. The sides of the cylinder, being alternately heated and cooled, communicate to the steam an average temperature which is lower than that of the live steam, and the consequence is a rapid condensation and consequent loss of energy during the period of admission of steam. Efforts have been made to overcome this difficulty by surrounding the cylinder with a steam jacket, or by dividing the expansion into several cylinders, in order to reduce the variations of temperature and the consequent total condensation to a minimum. Thus compound triple and quadruple expansions have been evolved, necessitating more movable parts of machinery and increasing the passive resistance. It has long been the aim of inventors to effect the expansion of steam necessary for economy of fuel by means of less complicated machinery and to avoid the oscillating movement. For the results attained through the investigations of one of them we will give an account below.

De Laval's steam turbine, which forms the subject of our first page illustration, is in principle exactly similar to the well-known axial jet turbine for water, being so arranged that the steam has acquired the same pressure as the surrounding atmosphere before reaching the turbine wheel, thus converting its entire capacity for work into momentum.

The steam passes between the blades of the turbine at a constant relative velocity and in a clear jet, without any disposition to further change its pressure or specific gravity. The consequence is that the movement of the steam in the turbine is according to the same laws as for water, and the blades of the turbine can, therefore, be constructed in the same manner as if designed for water.

Some idea of the size of the steam turbine may be obtained by reference to the lower figure of our first page engraving, which represents, actual size, the wheel of a twenty horse power steam engine now running at the World's Columbian Exposition, at Chicago, driving a duplex dynamo. This wheel is journaled in a steam-tight casing, in which are located the nozzles supplying steam to the turbine. The blades against which the steam strikes are made thin at the edge to reduce the resistance to the flow of steam. In this turbine steam is expanded to the pressure of the surrounding medium before arriving at the blades. This expansion takes place in the nozzle, and is caused by making the sides of the nozzle divergent. As the steam passes through the nozzle its volume is increased in greater proportion than the cross section of the jet, thus causing an increase in velocity. With an initial pressure of seventy-five pounds, and an expansion to the pressure of one atmosphere, the final velocity of the steam is about two thousand six hundred and twenty-five feet per second. If the expansion is continued to the pressure of one-tenth of an atmosphere, the resulting velocity will be about four thousand six hundred feet per second. It will thus be seen that expansion is carried much farther in this steam turbine than in ordinary steam engines.

The wheel is made of steel, the blades being cut out of the solid material by means of a milling machine. A steel ring is shrunk on the periphery of the wheel to prevent the steam from passing over the ends of the blades. It also serves to oppose the tendency of the turbine to act as a fan.

With the greatest possible care, it has been found difficult to perfectly balance the wheel. To meet this difficulty the inventor has placed the wheel upon a flexible shaft, so that the turbine when running at a high rate of speed adjusts itself and revolves on its true center of gravity, the center line of the shaft meanwhile describing a surface of revolution. If the shaft were rigid, the vibrations of the turbine wheel would be communicated to its bearings, which would heat and be liable to cutting.

The turbine wheel shaft extends into the gearing box and carries a pinion, 3, as shown in the detached view of the wheel and shaft. This pinion, which is double, engages a double cog wheel in the box, the pinion on the turbine shaft being one-tenth the diameter of the driven wheel, so that the speed of the latter is one-tenth of that of the turbine wheel, or two thousand revolutions per minute.

In the gearing box of a larger turbine the speed is reduced from 30,000 revolutions to 3,000 by means of a driver on the turbine shafts which set in motion a cog wheel of ten times its own diameter. These gearings are provided with spiral cogs carefully cut and placed at an angle of about 45°. On account of the high velocity, all tensions caused by the transmission of power are very slight; consequently, the cogs can be quite small, which is one of the conditions for even running of the gearing. The shaft of the larger cog wheel, running at a speed of 3,000 revolutions, is provided at its outer end with a pulley for the further transmission of power.

The turbine box of the large machine contains eight nozzles, of which four can be opened or closed by means of independent valves, according to the power required. The more exact regulation is effected by the governor. The turbine, therefore, can be made to work at the same pressure and degree of expansion even if the effect is varied as 2:1. The nozzles are easily accessible for removal and exchange, if required. The journals and gearing are lubricated from the oil cups on top of the gearing box. This machine is intended to work with condensation. A vacuum is obtained by means of any ordinary condenser. The nozzles are strongly divergent toward the opening, and the entire turbine box made perfectly tight.

The speed of the turbine is controlled by a very sensitive governor on the shaft of the larger gear wheels.

The segment weights or wings are movable on knife edges with the least possible friction. When the governor revolves, the weights diverge their inner ends, push a pin forward, this pin in turn causing the cut-off of the steam through the movement of a balanced valve in the steam supply pipe at the top of the turbine. A spiral spring inclosed in the governor keeps the weight in a state of equilibrium at a speed of 3,000 revolutions. It consequently corresponds to the weight of the collar on pendulum governors. The exhaust steam is taken from the center of the turbine box.

This turbine is applied to all uses to which ordinary reciprocating engines are applied, but in the running of dynamos, and in other uses requiring uniform speed, it has proved itself superior to reciprocating engines.

This engine is on exhibition at the Swedish Section, K 22, Machinery Hall, World's Columbian Exposition, Chicago, where the inventor, Dr. Gustaf de Laval, is represented by Mr. Reinh. Hornell.

Working Harveyized Armor Plate.

The naval authorities are experiencing difficulty in preparing the Harveyized armor plates for use. Although the Harvey plate has beaten all others, as is generally conceded, it is a question whether the plates can be successfully fastened to the vessels without impairing their high efficiency. The Harveyized plates are so much superior in hardness to plain and nickel steel plates that the tools used heretofore are useless. The armor for the Maine has recently been supplied by the Bethlehem Company, but the constructors have not as yet discovered any feasible method of fastening on the armor without cutting out spaces and drilling to fasten the plates to the side. With the Harveyized plate the tools will do the cutting after the steel has been softened. It is believed that this local softening of the steel will weaken the steel so that its qualities will be reduced to those of nickel plate. Another point is also brought forward: the late Mr. Harvey received $96,000 for the right to use his process, and the department is also paying a royalty of one cent a pound for all Harveyized plate, so that the new armor plate is already very expensive and will be doubly so if certain parts require to be re-treated. The matter is being investigated, and it is hoped that some method will be devised for putting on the armor plate without the necessity of an expensive operation which doubtless injures the value of the plate.

A WATERPROOF preparation for coating walls, paper, and other fabrics, and water supply pipes. The composition is manufactured by dissolving shellac or resin in methylated spirit with application of heat. To the partially cooled solution lead carbonate and carbolic acid are added.

THE AMERICA'S CUP WON BY THE VIGILANT.

In our last issue we gave views of the Vigilant and Valkyrie, the two competitors in the international regatta for the America's cup. As we go to press the progress in the matter is represented by three complete races and by two failures, the latter owing to lack of wind. America retains the cup. The first race was sailed on Saturday, October 7, in rather a light wind. The yachts started off from the New York lightship, dead before the wind, both yachts setting spinnakers as they started. Our large illustration shows this start from an unusually fine photograph taken by our artist. The white yacht, the Vigilant, the representative of America, with her spinnaker almost spread, is crossing the line in company with the Valkyrie in the same condition. The general result of this race was entirely in favor of the American boat. The start was an exceedingly fair one, the Valkyrie having perhaps a few seconds advantage. The race was over a course of 15 nautical miles to leeward and return. This would have necessitated tacking on the return course, except that the wind changed, enabling both boats to dispense with tacking on the return. The outer mark was turned by the Vigilant 8 minutes 6 seconds ahead of the Valkyrie. On the return the Valkyrie gained a little on the Vigilant, leaving her 7 minutes 36 seconds ahead. On account of the larger sail area and slightly greater length of the Vigilant, a time allowance of 1 minute 48 seconds has to be subtracted from the above, the Vigilant being the winner by 5 minutes 48 seconds corrected time. The Vigilant's time for the thirty nautical miles was 4 hours, 5 minutes, 47 seconds, the Valkyrie's 4 hours, 11 minutes, 35 seconds.

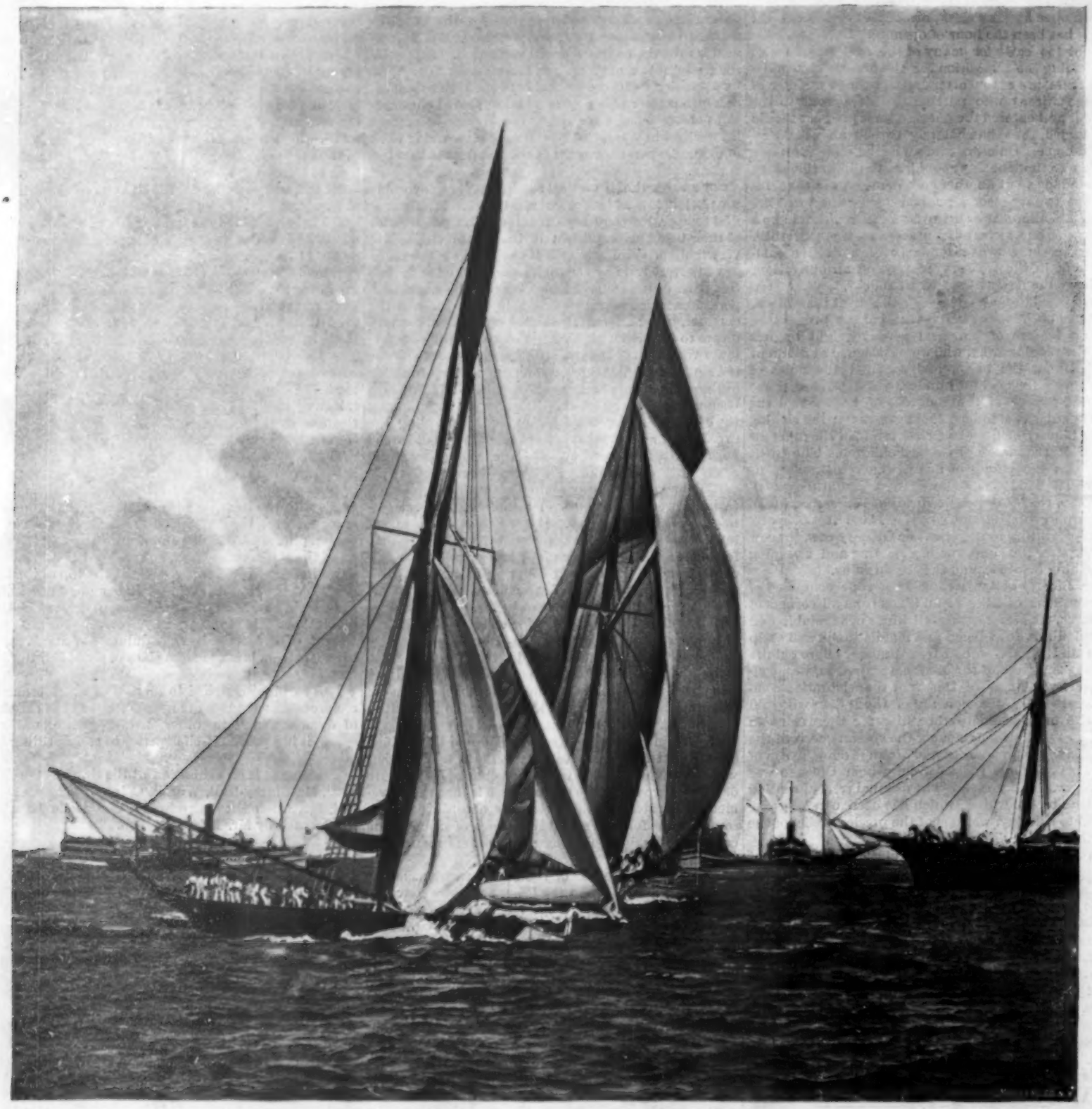
The second race, sailed on Monday, October 9, was over a triangular course of 10 nautical miles on each side. The first leg of the course was dead to windward, and the other two legs were sailed in a side wind, or "reaching" as it is termed. On this day the wind was considerably stronger than on Saturday and the Vigilant gained on every point. On the first leg the gain was 4 minutes 55 seconds, on the second leg 4 minutes 12 seconds, and on the third leg 3 minutes 26 seconds. The total gain of the Vigilant was 12 minutes 23 seconds, from which must be deducted 1 minute 48 seconds, giving the corrected time 10 minutes 35 seconds as the winning difference. The Vigilant's elapsed time was 3 hours, 25 minutes, 1 second; the Valkyrie's 3 hours, 37 minutes, 24 seconds.

The third race, sailed on Friday, October 13, was the closest. A wind from the east kept freshening until it blew almost a gale. The course was 15 miles to windward, nearly due east, and return. Owing to a slight accident to the Valkyrie, a delay of an hour was experienced in starting the boats. The wind gauge at Sandy Hook now showed thirty miles an hour. The Vigilant crossed the line five seconds behind the Valkyrie, thus being handicapped to that amount. The head sea seems to have told against the Vigilant, as she turned the stake boat behind the Valkyrie. But on the run home she made up this difference and crossed the line slightly ahead of her rival.

The Vigilant's elapsed time was 3 hours 24 minutes and 39 seconds. The Valkyrie's time was 3 hours 25 minutes and 19 seconds. The winning difference in the Vigilant's favor by corrected time was only 40 seconds.

On the beat to windward for the first time the relative qualities of the two boats in tacking in a heavy head sea and strong wind were seen. The Valkyrie made the best start and possibly blanketed the Vigilant several times. At any rate she managed to round the stake boat one minute and fifty seconds ahead. Both boats had reefed mainsails. After turning, the Vigilant shook out her reef, and with spinnakers set the two ran home. The Vigilant crept up on her rival, managed to trouble her by cutting off her wind, and eventually passed her. This was near the end, and quite probably the Valkyrie would still have won if her sails had not failed. She tore two spinnakers in rapid succession and finally used a balloon jib topsail to run in with. But this succession of troubles was offset by the fact that the Vigilant could not raise her centerboard. It was jammed fast and she had to drag it home with her, while running before the wind.

The time was excellent in this race, and the series go to show that in heavy weather the two boats are of nearly equal merit, while in smooth water the Vigilant is undoubtedly the faster. During the yachting season such days as that of the last race are few and far between.



THE VALKYRIE AND VIGILANT STARTING IN THE FIRST RACE FOR THE AMERICA'S CUP.

WHEN a glass stopper sticks in the bottle, pass a strip of woolen cloth round the neck of the vessel and seesaw it backward and forward. This friction heats and causes the neck to expand, so that the stopper becomes loose. On this principle of expansion by heat a tight screw may be withdrawn from a metal socket by surrounding the socket with a cloth dipped in boiling water.

THE WORLD'S COLUMBIAN EXPOSITION—A VIEW ON THE GRAND BASIN.

The great Exposition is noted for its peerless views, and not the least imposing is that of the Grand basin, obtained from the Palace of Electricity, as shown in our engraving. In the foreground will be noticed the luminous fountain, which in the daytime is only a skeleton of pipes and nozzles, but at night is transformed into a blaze of glory. Trap doors allow the privileged visitor to descend and examine the maze of pipes and wires. To the right of the luminous fountain rises the Columbian fountain, or MacMonnies fountain, as it is usually called, which represents Columbia enthroned, the personification of liberty, power and freedom. Father Time acts as steersman of the Ship of State, which is propelled by eight female figures, representing the arts and sciences. In the bow stands Fame, proclaiming the progress of the nation. The mediæval barge is drawn by sea horses, which are modeled in the most spirited manner. The fountain is fine by day, but at night the real magnificence of the composition is brought out when the search lights are trained upon it. The view of this fountain from the Grand basin is very fine. The flowing of the water over terraces or steps greatly adds to the general splendor of the work. Beyond this fountain, on the right, will be noticed the façade of the Palace of Machinery. The architects of this building were Messrs. Peabody & Stearns, of Boston, and the huge structure measures 1,393 by 490 feet. The vista is closed by the classic Colonnade. The shores of the Main basin and the North and South canals are dotted here and there with charming pieces of sculpture, representing the animals of our own country. Four huge lions support the base of the tall obelisk which forms the end of the South canal.

At the left in our engraving is seen the front and side of the Palace of Agriculture, a masterpiece of architecture, by McKim, Meade & White, of New York City. This building and the Art Gallery are considered the two finest buildings on the grounds. The rich decorative work on the Agricultural building finds its motive in subjects native to America. The horoscope groups which surmount the corner pavilions of the Agricultural building are especially fine, four graceful female figures supporting a globe. The Agricultural building measures 500 by 800 feet. No one who has looked upon the scene of beauty presented in the Court of Honor can do otherwise than regret that within a few days' time these marvelous structures forever will have disappeared.

THE WINNER OF THE INTERNATIONAL RACES—THE VIGILANT.

PALACE OF AGRICULTURE. THE COLONNADE. PALACE OF MACHINERY.

THE LUMINOUS FOUNTAIN. MACMONNIES FOUNTAIN.

THE WORLD'S COLUMBIAN EXPOSITION—A VIEW ON THE GRAND BASIN.

CACTUS FURNITURE AND ART WARE AT THE WORLD'S COLUMBIAN EXPOSITION.

BY H. C. HOVEY.

About a thousand different species of the Cactaceæ have been found, mainly inhabitants of the new world. They abound in the dry regions of tropical America, and certain varieties are widely distributed through the southern parts of the United States. Transplanted to Europe, some of the opuntias have flourished along the Mediterranean, almost as freely as if indigenous. Many varieties of the cactus family are admired for their singularly twisted stems, tufts of sharp spines, formidable thorns, or bright flowers. For this reason they are favorite objects in conservatories. The more thorny kinds are planted as impenetrable hedges around houses in Mexico and South America. The fruits, especially of the opuntias, are edible, and are better known as prickly pears, or Indian figs. The turnip-like roots of the giant mescal are roasted by the Indians, and from the juices of the same a favorite Indian drink is made. The cochineal insect is raised on the nopals, as many as fifty thousand plants being sometimes found in a single orchard kept for that purpose. But until recently it was thought that, aside from the above uses, the cactus was a sad cumberer of the ground, with very few redeeming qualities.

It has long been known that a woody axis grew under the thick, fleshy stems of the cactus, sometimes quite compact in substance, and again with large round or oval openings. The wood of the growing plant has a soft and worthless fiber; but from the stems of dead plants, as found on the plains, the Mexicans have been accustomed to make canes, which they have sold to tourists as souvenirs.

This has suggested to an enterprising Arizona firm the idea of manufacturing art ware and small articles of furniture from the same material. Their factories are located at Tempe and Phœnix, and the manufactured products are exhibited for the first time in the department of the Liberal Arts at the Columbian Exposition. A medal and diploma have been awarded for the novelty of the material and superiority of the work shown. My attention was called to it by the presence of an admiring crowd, among whom were members of the Swiss Commission, who stated that it would be difficult to find, amid all the many articles of hand-carved ware exhibited from Europe, any so intricately and perfectly ornamented as were here to be seen in the handiwork of nature's carving. And, so far as the writer has knowledge, the public attention is now called to these unique products for the first time through the press.

In reply to inquiries, I was told that the varieties of cactus most suitable for use grew at a high altitude, and had a peculiar grain and smaller pores than similar plants in the valleys. The wood must be obtained from plants already dead, or else be subjected to a special process of seasoning. Green plants are soaked in vats containing a weak acid solution for from six to eight weeks, till all the pulpy leaf, thorns, etc., are completely eaten away. What remains is a very hard and tough woody substance, lighter than pine in weight, and varying in color from corky yellow to dark brown. Its wearing qualities resemble butternut or walnut.

The cholla (*Opuntia fugida*) is regarded as best for cabinet work; for which the stalks are split, steamed, and flattened into boards—a fact more easily understood on remembering the great size to which certain cactus plants grow in Arizona and Mexico. In my travels through that region I have seen specimens whose stalks were twenty feet high and a foot or more in diameter. The fiber of the giant cactus, however, is liable to be pithy, for which reason it is less desirable than some of the smaller kinds. Nearly all varieties of cactus can be made serviceable.

Some of the daintiest art ware imaginable is made from the lace-like fiber of the nopal (*Opuntia Engelmanii*). Sheets of it are steamed and pressed under heavy steam rollers. The result is a natural filigree, very delicate in appearance, but extremely strong. What most excited admiration were the choice veneers made from both the boards and the filigree fiber, and which have advantages over every other kind of veneer known. Being porous, the substance can be filled in with any desired art color or tinted cement. When subsequently polished the effect is indescribably beautiful. This fact enables the expert cabinetmaker to match his veneers to any interior decorations or furniture upholstering. No other kind can have its original color permanently changed without making it seem tawdry or cheap. This evidently opens rare possibilities of fine artistic embellishment.

Among exhibited articles of cactus ware were canes, napkin rings, pick holders, smoker's sets, match safes, inkstands, and numerous other interesting small articles. But the novel material is by no means limited to such minor objects. Elegant stands, tables, easels, music racks, stools, fire screens, hat racks, and mantelpieces were shown as proofs of what could be done with the once-despised cactus. In picture frames a remarkably pleasing effect was produced by showing the filigree work over silk, and a worker in silver filigree expressed his opinion that the costly wares and ornaments of that metal could be admirably imitated by a suitable preparation of the vegetable filigree and afterward plating it with silver.

The picture of the candelabra cactus represents a very common scene in New Mexico. The columns, straight and angular, are often sixty feet high. It is called a torch cactus in some places. Some lie on the ground; others, attached to trunks of trees as parasites, hang from branches like great serpents.

THE CANDELABRA CACTUS.

Bullets as Microbe Carriers.

Living animals, it is supposed by some philosophers, may have been brought to this earth in meteorites. Parallel with this idea, some interesting experiments have been recently made in Germany to ascertain if rifle bullets can carry infection. It has long been known that in war gunshot wounds very frequently induce symptoms of acute tetanus or lockjaw, which nearly always ends fatally. Messner's investigations show that if rifle bullets are purposely brought in contact with micro-organisms and then discharged in the usual way they carry the microbes with them into whatever material they subsequently penetrate; the microbes, moreover, suffer no damage and grow as abundantly as ever. If ordinary uninfected bullets were fired through flannel which had been previously infected with germs, they carried the latter with them. It is easy, therefore, to understand how gunshot wounds many cause lockjaw and other diseases. The tetanus organism is widely distributed in the earth, and the bullet, either by first striking the latter and then wounding, or by simply penetrating the soiled uniform of the soldier, can thus readily become the carrier of infection.

Electrical Injuries to Gas and Water Pipes.

The destructive action of electric currents extends to water and gas pipes and to almost all other buried metals. The Bell Telephone Company, of Boston, has recently made a report on this subject, which embodies a large amount of useful information. The overhead single trolley system of electric railways seems to be the cause of most of the corrosion. The heavy currents appear to follow the cable sheaths of telephone cables as conductors. The lead of the cable sheaths is corroded wherever the current leaves the cable and passes into moist earth or the moist air of the ducts or manholes. The destruction has occurred in some places where the potential was less than half a volt. As long as the single trolley system is in use similar results to those obtained in Boston may be expected. The injury to water and gas pipes is as serious as that done to telephone cables, as may be seen by the photographs which accompany the report.

Rose Growing and Pressing in Saxony.

The experimental rose plantations started two years ago in the neighborhood of Leipzig have given such brilliant results that they are, the Belgian consul states, being extended. The plants have thriven well through the long and severe winter of 1892-93, and their condition in May left nothing to be desired. It has been shown that it was a false idea to suppose that these flowers require Oriental heat to prosper and acquire a delicate perfume; the experiments at Leipzig having proved that a cool temperature, and even a little damp, is the first condition of a good yield, while great heat is the enemy of roses. A special factory has been established in the middle of the plantations by the house which made the first experiments, and it is to be put in operation this summer. Provision is made for dealing each day—we quote the consul—"with 50,000 kilogs. of leaves, producing, at least, about 40 kilogs. of oil, water, and pomade of roses, valued at 40,000 to 50,000 marks. To start with, the factory will have three boilers providing 300 square meters of heated surface, and the roses will, immediately they are plucked, be transferred to the macerating jars, where, thanks to this procedure, they will deposit their perfume in all its freshness and delicacy. Only the quantity of leaves required at the moment will be collected, a few minutes sufficing to transfer the leaves from the plant to the machines." *Commerce* of the 26th July adds: "This expedition is favorably contrasted with the procedure followed in Turkey and in France, where frequently the roses plucked in the morning are only distilled in the evening. As to the oil of roses produced in Saxony during last year, it is claimed that not only did it not fall short on comparison with the Turkish product, but that it was better than its rival in delicacy and strength, and the lasting character of its perfume."

Compulsory Paper Money.

The proposal to return to the old plan of paper money and State banking brings to mind the paper money scheme of Rhode Island.

In the year 1776 Rhode Island tried that experiment to her heart's content. The historian (McMaster's History of the People of the United States) tells us that "in the course of the debate which preceded the passage of the paper bill in the legislature, it was noticed that the speakers on the affirmative were invariably from the country districts, and the debaters on the negative as invariably from the rich seaboard towns. Newport, Providence, Bristol, Westerly, each sent up men trained in the great school of commerce and trade, familiar with all questions of finance. . . . But no argument which they could advance could turn the votes of men who had come up for the express purpose of abolishing taxes, suspending the excise, and emitting a currency which was, in their belief, to flow into their pockets much faster than it could possibly flow out."

"A call was made for a forcing act, which the legislature quickly passed. Every one who should, according to this act, refuse to take the bills in payment for gold, or should in any way discourage their circulation, was to be fined £100 and lose the rights of a freeman."

"The effect of the law was to make worse the matter it was designed to mend. The merchants denounced it iniquitous, and declared they would pack up their goods and set off for another State before they would submit to so wicked an act. Indeed, they refused, almost to a man, to make any sales. The traders followed their example and closed their shops or disposed of their stock by barter. For a time business was at an end, and money almost ceased to circulate except among the supporters of the bank. Rent was paid in grain; nor was it by any means, in some towns, a rare thing to see cobblers exchanging shoes for meat and shopkeepers taking cords of wood for yards of linen."

Butt-Welded Steam Pipes Not Safe.

Assistant United States Inspector of Boilers Lyman Howard, reporting on the cause of the explosion on Mr. Coggeswell's yacht Feiseen in the Lower Bay, September 9, found that one of the 2,000 pipes in the Feiseen's patent "safety" boiler had burst near the base of the furnace on the port side. The pipe was what is known as a "butt weld," and was defective in the weld. The assistant inspector calls attention to the fact that "butt weld" pipes are not considered safe in high pressure boilers.

Gold in Ocean Water.*

The waters of the ocean contain gold. In 1831, Malaguti and Durocher determined the occurrence of silver, but did not extend their inquiries into the question of the presence of gold in sea water. This fact was first accurately determined by Sonstadt in 1872. His experiments were not quantitative, but he stated, in parenthesis, that the amount was "certainly less than one grain in the ton." More recently, however, Munster found an average of five milligrammes per ton. In endeavoring to arrive at an approximate estimate, it must be remembered that local conditions, such as the temperature of the water, will affect the amount in solution. Sonstadt's researches were made with water obtained near Ramsey, in the Isle of Man, while Munster got his from the Kristiania Fjord. In each case the sea water was that of a northern latitude. In warmer regions it is probable that precipitation, due to the presence of putrescent organic matter, may diminish the amount of gold held in solution. Let us, however, take five milligrammes (equivalent to one-thirteenth of a grain) as an approximation. This, though in itself a minute quantity, will be found to represent an enormous total amount of gold in the waters of the ocean. From the results obtained from the careful soundings carried out by the Challenger and similar scientific expeditions, it has been computed that the ocean has an average depth of 2,500 fathoms, and that it contains four hundred million cubic miles of water. This is equivalent to about 1,837,030,272,000 million tons, which upon the basis of five milligrammes per ton would represent 10,250 million tons of gold. By way of contrast, it may be added that, according to Soetbeer, Leech and others, the gold production of the world, from the beginning of 1493 to the end of 1892—a period of exactly four centuries—has amounted to only 5,020 tons. The present output is equal to about 200 tons per annum.

The gold in sea water is kept in solution as an iodide. The amount of free iodine present in the ocean is very minute, but a large proportion of that element occurs combined as an iodate of calcium. From the results of a series of six experiments, Sonstadt found that a cubic mile of sea water contains about 17,00 tons of iodate of calcium, or 11,072 tons of iodine. This represents the occurrence in the entire ocean of no less than 4,428,800 million tons of iodine.

The iodine which maintains the gold in solution is obtained from the iodate of calcium. Gold is soluble in extremely dilute solutions of iodine, which, under ordinary conditions, are in turn readily reduced by organic matter. That the gold in the sea is not precipitated is due to the presence of the iodate of calcium, in which it is not soluble, but which, being readily decomposed by *putrescible* organic matter, liberates the iodine required to keep the gold in solution.

There is reason to believe that the sea waters of today contain much less iodine than those of former geological periods. That there is so little free iodine in the ocean is due to causes parallel to those which bring about the noteworthy absence of carbonate of lime. Marine animals abstract the latter while marine plants absorb the former. How great is the work done in this way is evidenced by the dimensions of the coral reefs and by the extent of the foraminiferous and other marine limestones.

The abstraction of iodine is no less striking. Seaweeds, and more particularly those which grow at great depths, are the chief source of the iodine of commerce. When, after a storm, such seaweeds are cast upon the shores of Great Britain, France and Sweden, they are collected and burned, and from their fused ashes, termed "kelp," the iodine is subsequently extracted by a simple chemical process. From 13,000 kilos of kelp, about 10) kilos of sodium carbonate and 15 kilos of iodine are obtained.

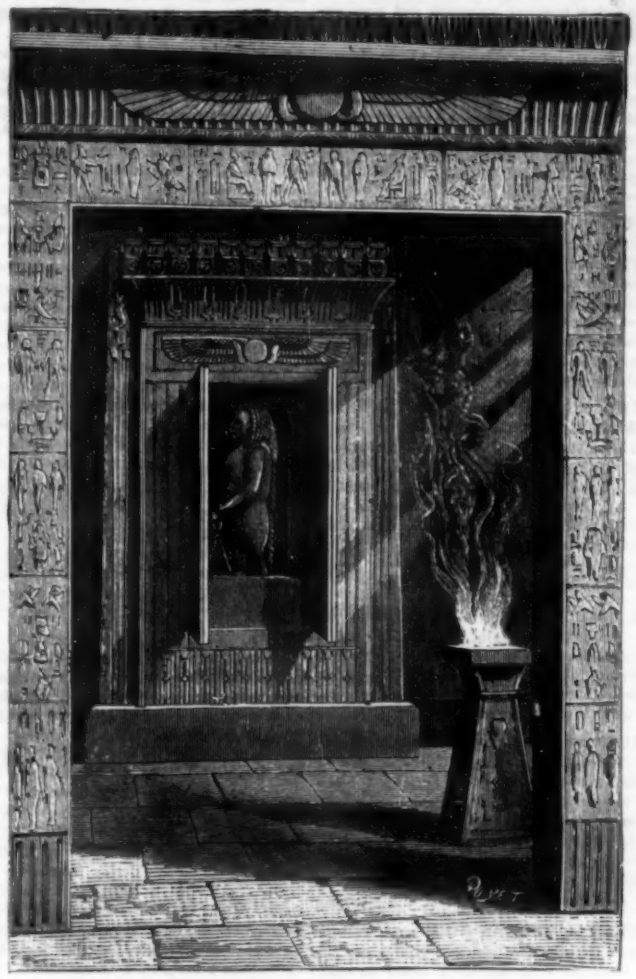
That iodine is not now so plentiful in the sea as during former geological periods has been suggested by chemical investigations into the composition of rocks. Certain sedimentry formations contain notable quantities of it. It has been found in some aluminous shales in Sweden and also in certain varieties of coal and turf. The saline waters of several springs contain large amounts of it. Even rain water has been known to give a recognizable iodine reaction when tested, such iodine having been obtained by the agency of winds which have been blowing over certain areas of the sea where it was being liberated by the action of organic matter upon the iodate of calcium.

THE Romans built the first dikes in Holland.

*Extract from paper read by T. A. Rickard, of Denver, Colo., before International Engineering Congress, Chicago, August, 1893.

THE MYSTERIOUS CHAPEL OF HERON.

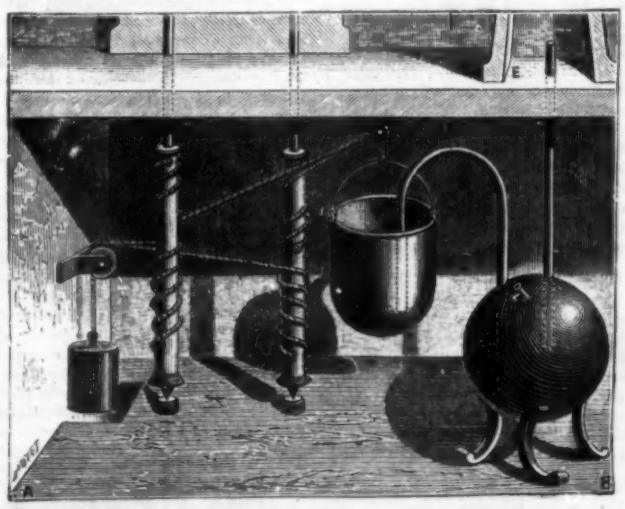
The accompanying engravings represent the construction of a chapel the doors of which are opened by kindling a fire on the altar adjacent, and which closes automatically when the fire goes out. This apparatus is described and illustrated in a work entitled "Les Origines de la Science," by Albert de Rochas, to which we are indebted for the cuts and description.



MYSTERIOUS CHAPEL OF HERON.

When a fire is lighted on the altar, which is hollow, the air contained within will expand and will be forced into the globe beneath, and will force the water contained therein through the bent tube into the pail, which is suspended by cords passing over a pulley and wound around two movable cylinders, which are the prolongations of the axes by means of which the doors are operated. Two other cords are wound around these same cylinders in an opposite sense, and after passing over a pulley support a counterbalance weight at their outer end. When, therefore, the water passes into the receptacle the equilibrium will be disturbed, and the receptacle will descend and the cylinders, will be rotated, thereby opening the doors with which they are connected.

This operation is reversed when the doors are closed.



APPARATUS FOR OPERATING THE DOORS OF THE CHAPEL BY MEANS OF HEAT.

The bent tube which connects the pail and the globe forms a siphon, the longest arm being inside of the globe. When, therefore, the fire on the altar is extinguished, the air in the altar and globe becomes cold and diminishes in volume and forms a partial vacuum, which draws the water from the pail into the globe. When all the water in the pail has been withdrawn, the receptacle will rise under the influence of the counterbalance weight, and this weight, by means of its cords, will rotate the cylinders in the reverse direction and will close the doors of the chapel. Heron states that mercury may be substituted for water, which in some cases may be of advantage, because of the greater weight of the mercury.

Patent—Infringement—Royalties.

In the case of The Standard Button Fastening Company *vs.* Ellis *et al.*, recently decided by the Supreme Judicial Court of Massachusetts, which was an action of contract to recover rent or royalties for the use of certain button-fastening machines which were patented by plaintiff, it appeared that while the agreement authorizing the use of the inventions by the defendants was still in force, the patent was adjudged an infringement and invalid. The defendants claimed they were not liable for the rents subsequent to the said adjudication of invalidity. The court sustained a finding for the plaintiff, saying: "So far as the invention described in the letters patent is concerned, the so-called lease was merely a license. No exclusive rights were granted thereby, and anything short of a grant of exclusive rights is a license. A license imparts no warranty that the patent is valid, and no case has been found which holds that a covenant for quiet enjoyment of the right to use the invention is implied. The analogy to a lease of land is not very close. A license to use a patent invention gives permission to make such use so far as the licensor can give such permission; that is, to use it so far as that can be done without infringing other patents. Where a grant of an exclusive right is made, if the exclusive right fails, the consideration of the grant fails. But where a mere license is given, it is held that there is no failure of consideration till the licensee is actually prevented from using the invention. The fact that the license is contained in a lease of a machine does not alter its character. No question arises under that portion of the contract between the parties which is properly regarded as a lease. The only questions are in relation to the right granted to use the patented invention. This right is a license, and is quite different in its legal effect from rights under a lease. No covenant for quiet enjoyment is implied in a license to use a patented invention. When the defendants were prevented from using the invention, they might have refused to pay for the rent or royalties and given up the use of the machine. They did not, however, do this. They continued to use the machine, and now admit that this makes it their duty to pay the rent. There being no implied covenant for quiet enjoyment, this ground of defense fails."—*Bradstreet's.*

Labor Day.

We must confess that we never hear "Labor Day" or "Labor's Holiday" mentioned without a feeling of contempt and disgust for the impudent demagogism on one side, and cowardly servility on the other, which have brought the descendants of those who prepared and defended the Declaration of Independence down to the embodiment in legislation of the idea that, instead of all men being born free and equal, there are two sorts of men in this republic, one consisting of the members of certain organizations, and the other including the miscellaneous persons who do not belong to these organizations, and that those who do belong to them are entitled to favor and recognition from the government which is not accorded to other people. In a community whose whole public system is founded upon the idea that there should be no class legislation, it is certainly curious to find, of late years, statute after statute enacted at the demand of the crafty and ambitious foreigners who control the forces of "organized labor." For several years "organized labor" has, or would have had, but for internal squabbles, things pretty much its own way in the legislatures, but just now circumstances which neither legislatures nor walking delegates can control have given a very large number of citizens more leisure than usual for thinking, and there are indications that a good many of them are reflecting whether, after all, they might not be as well off in the simple capacity of "free and equal" citizens of the republic as they are now in that of abject slaves of a foreign tyranny which dictates to them when, how, with whom and at what price they shall work, which prevents them from teaching their own business to their own children, and which forces them to sit idle and see their families suffer, when work is plenty, for the sake of "sympathizing" with some other people, of whom they never heard, and whose relations to them consist solely in a concerted scheme of their respective leaders for their private advantage. —*Amer. Architect.*

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

MAIL BAG CATCHER AND DISCHARGER.—George W. Dailey, Charlottesville, Ind. This improvement comprises an open-sided cage having a yielding top, a spring-pressed carriage sliding in the cage, a trigger extending forward from it having a striker arm, and mechanism operated by the trigger shaft to release the carriage. The apparatus is designed to simultaneously discharge mail bags from the station and from the moving car, also at the same time receiving bags discharged, the stationary apparatus discharging a mail bag into the apparatus on the car and receiving one in exchange, and vice versa. The apparatus is very positive and purely automatic in its operation.

MAIL BAG HANGER.—Milton Trundle, Kansas City, Mo. This is a device for supporting mail bags in proper position to be caught by a grab hook on a passing car. The invention includes devices detachably connected with the mail bag, for holding it properly suspended, and also a slidable frame to which the devices are loosely connected, the frame sliding in a slotted post at the side of the track. The hanger is readily adjustable as to tension of the grip and also as to proximity to the track.

Mechanical.

FILE CUTTING MACHINE.—Frederick W. Lowe, Philadelphia, Pa. A horizontally adjustable swivel block with concave upper face carries a swinging frame having a convex projection on its lower face fitting the concavity, the axis of the frame being the center of the arc described by the convex and concave faces, while a carriage has an intermittent sliding motion in the frame, and a reciprocating hammer carrying a chisel operates over the carriage to produce cuts on a file blank. The machine is designed to produce perfectly cut files, greatly resembling those made by hand, is perfectly under the control of the operator, and turns out the files very rapidly. It is of simple and durable construction.

PIPE WRENCH AND CUTTER.—George Plante, Lowell, Mass. A handle carrying a fixed toothed jaw and an angular jaw has also a pivoted arm carrying a cutter adapted to operate in conjunction with the angular jaw, the cutter arm also carrying a movable jaw to operate in conjunction with the fixed toothed jaw. The improvement forms a strong and simple tool for conveniently turning a pipe or rapidly cutting it in two parts.

BELT FASTENER.—John Stocker, New Lewisville, Ark. This is a hinged wire fastener for securing the meeting ends of belts, and consists of two U-shaped links interlocked at their bends, with their legs terminating in flattened prongs, which are secured by clinching in the leather or other material of the belt. The fastening permits of the free curvature and movement of the belt in all directions.

CAN LABELING MACHINE.—Adrian S. Boiteuillet, Brunswick, Ga. In the floor of an inclined chute is a revolubie and vertically movable tripping roller, a series of pasting rollers being arranged above the chute, and an open-topped label box at its lower end, while a feed mechanism raises the floor of the box to keep the top label flush with the box top. It is a comparatively simple machine to automatically paste and apply labels to cans and bottles of various kinds.

TOBACCO CUTTER AND SIFTER.—Louis C. Josselin, City of Mexico, Mex. Beneath a hopper supported by a suitable frame is a revolubie exterior cutter, having cross knives with their edges turned inwardly, in connection with a revolubie interior cutter having diagonally arranged knives with their edges on their outer portions, there being a sleeve for the cutters and backles secured to the outer knives to contact with the sleeve. The machine is adapted to rapidly cut tobacco to any degree of fineness, and thoroughly sift it.

WIND WHEEL.—James C. Walker, Waco, Texas. The arms or frames are arranged to rotate about a vertical axis upon a horizontal plane, and are so constructed that no guiding vane or tail is required. The space between the outer edge of the frames is occupied by wings or blades which open or close automatically. The force of the wind will close the blades on one of the revolving arms, and will open them and blow through the opposite revolving arm.

EAVES TROUGH HANGER.—William H. Mandwiler, Attica, Ohio. By the use of this hanger, eaves troughs may be attached to roofs without the use of nails, which injure the roof, and are impracticable where slate has been used. A hanger is attached to the roof by means of a spring clamp. The trough is hung upon the hanger and locked in position by means of a wedge, which serves as a key and holds it firmly in place.

Miscellaneous.

AIR DISTRIBUTING FAN.—Ardon M. Mitchell, Brooklyn, N. Y. This is a ventilating fan to be rotated by pneumatic pressure and air escape from within the device, the ordinary driving mechanism for such apparatus being dispensed with. It has hollow perforated fan blades radiating from a hollow shaft supported to rotate in a pendent chamber, and the air is delivered in graduated jets from one edge of each fan blade, there being a sliding gate to close the perforations, regulating the escape of the air currents and controlling the speed of rotation.

DYNAMICAL ARRANGED CELESTIAL MONITOR.—Mungo Turnbull, Toronto, Canada. The design of this improvement is mainly founded upon the modern astronomical equatorial mounted telescope, a celestial sphere of simple and durable construction being provided and arranged to permit of conveniently reading the position of any object in the heavens, from pole to pole, on any parallel of latitude or right ascension, at any time during day or night throughout the year. The sphere is to be not smaller than eighteen inches in diameter, and is provided with a representation of stars visible to the sixth magnitude on both hemispheres, with means for indicating the positions of the observer on the earth, relative to the sphere and time of observation, to obtain a true vision of the stars on the sphere from the point of observation.

RACK FOR FIREARMS.—Jesse A. Meadows, Sackett's Harbor, N. Y. This is a rotatable rack, having a central post and a lower platform holding the butts of guns or rifles, an upper platform receiving the muzzle ends of the guns and also having pistol pockets. The rack holds a large number of firearms, and when closed and locked all will be secured at once, but when the lock is removed the pistols and guns are securely held against falling out.

FILTER FAUCET.—Edward O. Wilson, Jersey City, N. J. This faucet has a casing in which are transverse perforated partitions forming filtering compartments, the first compartment next the supply pipe being preferably a settling chamber, the next one being filled with charcoal, and the third with gravel, and the water being cleansed as it is passed through these chambers to the discharge outlet.

EDUCATIONAL APPLIANCE.—Alexander Macfarlane, Austin, Texas. This is a device formed of rods secured together to form a spherical triangle, and with other rods arranged as extensions to demonstrate the cosine and sine of the sum of two angles having different axes. The improvement is designed to facilitate the teaching of mathematical mechanics and physics in such manner as to demonstrate and exhibit the principles involving directed quantities in space.

PENCIL SHARPENER.—Edward H. Boehme, Chicago, Ill. In this sharpener the lead is supported while being sharpened, thus avoiding the breaking of the point, and the wood is cut in the direction of the grain, in the same manner as when the pencil is sharpened with a penknife. The device consists of a guide in which a pencil holder is placed, while a slide moving in the guide is provided with a cutter for cutting away the wood and lead of the pencil, the latter being held at angle in the path of the slide and its cutter.

FENCE POST.—Joseph D. Paldi, Brockway, Mich. This post has a burnt clay body to which outer metallic clamp portions are bolted and provided with fence wire fastenings. The body has internal reenforcing wire portions, and the post may be very inexpensively made, and will not rot or burn.

TRIMMING.—George H. Newton, Monson, Mass. The invention relates to artificial flowers for ladies' hat and dress trimming; the object being to heighten the effect by means of movable parts connected by a crank shaft so that they will be actuated by the wind or by the motions made in walking. For example, a flower may be constructed with rotating leaves connected together, which in turning give motion to the center of the flower by the medium of a crank shaft.

UMBRELLA COVER.—Anthony Nicholas and Ludwig Tachan, of Newark, N. J. The object of this invention is to provide a means for readily changing the covering of umbrellas and parasols so that many different colored coverings may be placed upon the same frame. The covering is provided with fastening devices, which are adapted for removable engagement with the ribs, and the stick is provided with a locking device which secures the top of the covering where the stick passes through.

GAME BOARD.—Whitfield G. Howell, Highland, N. Y. This game consists of a board provided with a series of holes of a size adapted to allow marbles propelled by a mechanism, forming a portion of the board, to pass through and fall into a drawer provided with pockets numbered to correspond with the openings above. Deflecting blocks add to the interest of the game, which is intended for table use, as they make the shots from the freely pivoted and movable propelling mechanism more difficult.

FACE PROTECTOR.—Carl Gumeson, National Mine, Mich. This device is intended to protect the face from extreme cold. The protector is made of any suitable material fastened to a mask frame, and is provided with eye, nose, and mouth protectors, which are so arranged that speaking, breathing, or the eyesight is not interfered with, and at the same time the face is protected from extreme cold.

CIGAR ATTACHMENT.—Thomas Guilfoyle, Collingwood, Ontario, Canada. The cigar is passed through the lower portion of a funnel or hood, which is channeled out to receive it, forming a kind of pocket. The heat and smoke are deflected by the funnel so that they are kept away from the eyes and nose of the smoker, so that respiration may be freely accomplished without removing the cigar from the lips. The construction allows a free circulation of air to the lighted end, and at the same time prevents the cigar from "going out" as easily as when no such device is used.

TOY SOLDIER.—Charles Midforth Beaumont, of Hull, England. The object of this invention is to provide an amusing toy for children, and is intended to enable missiles to be discharged at a relatively long range, thus representing a mimic combat. The barrel of the gun consists of a tube through which a slender rod or dart is discharged by a fillip of the finger applied to the end of the rod, which projects at the rear of the gun to a considerable distance. The gun is held in the usual position of firing, with the butt to the shoulder.

HAT.—Raphael Buck, of New York City. The object of this invention is to provide a hat which, by the operation of a simple device, can be arranged so as to permit of a free circulation of air over the head of the wearer. The crown is made separate from the body, and is adapted to engage therewith. Connected with the body of the hat are arms which at their point of junction support a nut through which passes a screw terminating in the crown. By the aid of this screw the crown may be raised and held at a sufficient distance to allow of good ventilation, and still protect the head from the sun.

NOTE.—Copies of any of the above patents will be furnished by MUNN & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

PATENT OFFICE MANUAL; INCLUDING THE LAW AND PRACTICE OF CASES IN THE UNITED STATES PATENT OFFICE AND THE COURTS HOLDING A REVISORY RELATION THERETO. By George H. Knight. Boston: Little, Brown & Co. 1893. Pp. 655.

To any lawyer taking up patent practice as a specialty, this book must prove invaluable, while there are few lawyers who have been thus engaged for years who will not find it a great convenience and a valuable aid. Inventors, likewise, who go enough beyond the technical details of their improvements to care to master the somewhat complex state of the law as it at present exists, owing to the fine distinctions upon which numbers of decisions have been made by the courts, will find here the most ready means anywhere offered to attain such end. The author has had many years' experience as a Patent Office examiner, and thus came to the preparation of this book from the practical working side of Patent Office practice, and although the work consists almost entirely of brief summaries of or quotations from court decisions, or rulings of the office, every such decision and ruling answers a question which has come up in the practice of the office. The book is thus well adapted, according to the author's design, to facilitate the labors of inventors and attorneys in the presentation and prosecution of cases before the office. It is also brought down to date, covering many recent and important cases, and has as an appendix a chapter on copyrights. The author is a member of the Patent Office Bar Association, a resident member of the New York Academy of Sciences, and the author of "Relation of Invention to the Conditions of Life."

THE SCIENCE OF MECHANICS: A CRITICAL AND HISTORICAL EXPOSITION OF ITS PRINCIPLES. By Dr. Ernst Mach. Translated from the second German edition by Thomas J. McCormack. Chicago: The Open Court Publishing Company. 1893. Pp. x, 534. Price $2.50.

We have had occasion to note the publication of various works relating to the history of science, in many cases the virtual reproductions of memoirs by the discoverers in early days, but in Professor Mach's works we have what to some extent is an innovation. It is a treatise on modern mechanics in the full scientific aspect of the subject, but devoted very largely to the history thereof, and giving the little-known story of the deduction of what seem to us now axioms of science. Without perpetrating an absolute inconsistency, it may be said that the proof of an axiom or the basis of its establishment is always deeply interesting, and it is precisely to such topics as these that Professor Mach's work goes. As an example we may cite his treatment of the principles of the lever, showing the deductions of Archimedes, Stevinus, Galileo, Lagrange and others. Again, the inclined plane gives a characteristic example of the author's treatment. The mixture of history with the last principles of science and absolute mathematical deductions makes the work exceedingly attractive, but this very feature entitles it to and exacts the most deliberate reading. It really seems to fill a long-felt want. It is one of those books which has the rare happiness of suggesting a want in literature.

A SELECT BIBLIOGRAPHY OF CHEMISTRY, 1492–1892. By Henry Carrington Bolton. Washington: Published by the Smithsonian Institution. 1893. Pp. ix, 1212. Price $3.50.

Professor Bolton, who by years of labor has acquired special standing as an investigator into the history and literature of chemistry, presents us in the valuable work before us with an index of four hundred years' publications in chemistry. In saying the above, we feel that we have said almost enough, on account of the compiler's high reputation. It, however, should be stated what division is adopted by the author. The seven sections are divided into bibliography, dictionaries and tables, history of chemistry, biography, chemistry pure and applied, alchemy, periodicals. The arrangement of each section is alphabetical and cross references are used, at once directing the reader to the desired place. Various features deserve special commendation. Thus Dr. Bolton gives an extension of a list of abbreviations of titles of chemical periodicals on the lines of the one instituted by the American Association for the Advancement of Science, embracing 436 separate periodicals. Twenty-eight pages of addenda follow the main text, chiefly of works published while the foregoing pages were in press. While the book, as stated, is a gigantic index, Dr. Bolton has not hesitated to introduce an additional index, thirty pages in length, of subjects. The labor involved in the production of the volume is certainly very great, a total of over twelve thousand titles in twenty-five different languages being included. The book is "select," and makes no pretense to completeness. Thus we find among biographies those of Booth, Prescott, and Hunt, referred to our columns, the two last to the author as well, while similar biographies of Barker, Chandler and Cooke published in the SCIENTIFIC AMERICAN are not indexed. This is merely cited as an example of the want of system almost unavoidable in such work.

LAMP PRIMER; OR, LAMP LIGHT AND LAMPS, AND HOW TO CARE FOR THEM. By John Jonesbury. Columbus, Ohio: Harrop & Company. 1893. Pp. 88. Price 50 cents.

THE LUMBERMAN'S ACTUARY. By J. W. Barry, Fairbury, Neb. 1893. Narrow 12mo. Pp. 229, cloth. Price $2.50.

This is the most practical book of lumberman's calculations that we ever remember to have seen. The form is very convenient for the pocket and the contents are so arranged by a system of indexing that the price of any lumber can be found in an instant. The type is large and clear, very different from many of the cheap lumberman's price books. The author states that every one of the 120,000 separate calculations was figured through eleven times. The author offers a copy of the book or its price in cash to the person first reporting each material error. In short the ambition of the author seems to have been to produce the best possible book, to anticipate the perfection of the dawning morning of the twentieth century.

WORLD'S FAIR: JAMAICA AT CHICAGO. An account descriptive of the Colony of Jamaica, with historical and other appendices. Compiled under the direction of Lt.-Col. the Hon. C. J. Ward, C.M.G., Honorary Commissioner of Jamaica. New York: William J. Pell. 1893. Pp. 95.

This very attractive book, quite profusely illustrated, describes the island of Jamaica, its different harbors and pleasure and health resorts. The effect of reading it is to make one feel like going at once to the tropics and enjoying the beautiful scenery so graphically described and illustrated in this monograph.

DRUM ARMATURES AND COMMUTATORS: THEORY AND PRACTICE. By F. Marten Weymouth. Enlarged and revised from a series of articles in the *Electrician*. London: The Electrician Printing and Publishing Company, Limited. 1893. Pp. xiii, 294. Price $3.

A series of articles in the London *Electrician* enlarged and revised constitute this work. It is thoroughly practical and describes different systems of winding and connecting drum armatures. The troubles with armatures, such as the sparking at the commutators, receive due treatment. The work is also signalized by two indexes, one to the text and another to the diagrams. The practical nature of the book will make it much appreciated.

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SCIENTIFIC AMERICAN BUILDING EDITION.

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3. A dwelling erected at Holyoke, Mass. Perspective view and floor plans. A model design. Cost $6,900 complete. Mr. B. P. Alderman, architect, Holyoke, Mass.
4. A suburban cottage erected at New Haven, Conn., at a cost of $2,854 complete. Floor plans, perspective view, etc. Messrs. Wilson & Brown, architects, New Haven, Conn. An excellent design.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(5427) C. H.—Answer by Professor Riley.—The peculiar masses described by you are, from the description, not determinable with absolute certainty. It is possible that the description might apply to a variety of forms of fresh water larvæ, such as an aggregation of egg masses of some crustacean, or, more likely, a fresh water polyzoan, or some form of fresh water sponge. Fresh water sponges are of gelatinous structure, and lack almost entirely the silicious filaments which form the spongy substance of most salt water species. This would, therefore, in a measure correspond with the description of your correspondent, but more particularly since they develop what are known as winter buds or gemmules, viz., small oval bodies surrounded by a shell of silicious structure, similar to the sponge structure of the larger species. On the drying up of ponds, on the approach of winter, the chief spongy mass disintegrates and disappears; but these buds or circular masses survive the winter or the drought and develop under more favorable conditions of renewed moisture on recurring summer. The eggs of frogs are frequently discovered in similar masses, and being more or less surrounded and inclosed by a jelly-like mass, would perhaps offer an explanation of the phenomena described. If more accurate determination is desired, it can be readily furnished if the circular bodies mentioned be forwarded for examination.

(5428) Hercules, New Haven, asks: Do you consider it safe to pile about 300 tons of pig iron in a space of 60 feet by 6 feet within 3 feet of the foundations of a five-story factory building, the three upper stories running light machinery? The building is built on filled-in ground, and is piled throughout its 600 feet in length. A. The space occupied is 360 square feet and the load one and six-tenths tons to the square foot, not an unsafe load for the ground. As you say the factory is on piles throughout its length, the piling, if properly done, should carry the pressure of the walls of the building far below the influence of compression by the load of iron not in contact with the building. If the filling in is clean earth or sand, no harm can come from the load as stated.

(5429) E. R. P. writes for explanation of the following phenomenon: Pine Bluff, Ark., Sept. 29.—A tremendous rain poured down here this evening, and with it came millions of small frogs. They got into many stores, and the principal streets in the business part of the town were so covered with them that it was difficult to walk. A. The appearance of frogs and other small animals during heavy rain storms may be due to two sources, either lifted from shallow ponds or marshes by a tornado or waterspout, and distributed along the path of the storm, or that the excessive rain has driven them from their burrows and hiding places to the surface of the ground. If in the above statement the animals were really frogs, they may have fallen as stated. If they were toads, they were probably driven from their holes by the rain. We think the millions would be nearer the truth if much divided.

(5430) J. C. asks: 1. Can carbon be obtained absolutely pure in its elementary state? If not, why? Charcoal, even diamond, is not pure carbon, because it leaves ashes after burning. Can CO_2 be decomposed, leaving the carbon in the elementary state? A. Diamond is almost pure. It is impossible for man ever to get anything absolutely pure. His best is an approximation. CO_2 can be decomposed by heated magnesium, sodium, or potassium. 2. How is the carbon of electric arc lamp prepared? Leave any ashes in the lamp after burning? Is it analogous to ordinary combustion? A. Various methods are used. The powdered charcoal or carbon is mixed with sirup and water or other agglutinant, is moulded and baked. It produces ashes, and slowly burns. 3. The astronomers say that comets belong to the solar system; if this is correct, why don't they revolve around the sun, like planets? Where are the centers of their orbits? Does any comet really cross the orb of any planet, or is it simply theory? A. Comets and their orbits are still mysteries. They undoubtedly enter the planetary area. 4. Are the tides of the oceans due to the attraction of the moon. Is this a theory or determined fact? A. Though a theory, it is without the least doubt a true one. 5. Can the phosphate from bones be extracted without boiling (as in making soup)? If I grind the bones to fine powder, and then throw over boiling water (as in making tea or coffee), can I obtain a solution of phosphate for making soup? If not, is there any other way without boiling? A. Bone phosphate is insoluble in water. For fertilizing purposes it is made soluble by treatment with acid. 6. If any food substance, such as beans, or any starch compounds, is burnt accidentally upon the bottom of the pot, what shall I use to take off the burning flavor from the remainder? A. You cannot remove the flavor. You should use a double saucepan or water bath.

(5431) C. A. B., Iowa, writes: 1. While riding in the river bottom one day this fall, I noticed that the corn on one side of the road was badly frozen, while that on the other side was comparatively unharmed. Quality of ground seemed to be the same in both fields, and the elevation of the frozen field was a trifle greater than the other. Should judge not more than four or five feet. What caused this phenomenon? A. The causes tending to produce frost in certain fields or localities cannot be exactly defined. Unequal radiation in places near together or a slight difference in elevation may make just enough difference in radiation between adjacent fields to produce frost in one and not in the other. In the case cited the difference of a few feet elevation probably allowed the ground fog to be drifted toward the low land by the slow movement of the air, and thus protect it from loss of heat by radiation, while the higher field would be covered by a clearer surface atmosphere, which would increase radiation to the frost line of temperature. 2. Can you tell me how to remove wheels and collars from shafts, upon which they have been shrunken, without injury to either of them? A. If convenient to heat the shaft and wheel or collar to a low red, or possibly a black heat, just below the red and slowly cool it, so as not to injure the parts, the shaft may often be driven out of a wheel or collar without injury.

(5432) G. H. L. writes: 1. I noticed in a recent issue of SCIENTIFIC AMERICAN, a query by E. F. P. (No. 5377), in which he asks why a current of 1,800 volts taken from a primary battery would not have the same effect on the human body as a current of the same number of volts taken from a dynamo. Now, what interests me is, supposing a circuit breaker making and breaking the circuit many times per second were put in the battery line and both terminals grasped, what would be the effect? A. An interrupted current is much more severe on the human system than a steady one. The circuit breaker would greatly increase its severity. 2. How would you advise a person without necessary funds, interested in scientific researches (especially electrical), both experimental and inventive, to get an education in that line? Would such a person be able to procure a situation in some prominent laboratory? A. Go into an electric light station, work at anything to start, and then work up. Laboratory positions are hard to get.

(5433) M. C. asks whether a common filar micrometer could be used on a telescope with equatorial mounting not driven by a clockwork attachment. A. Good work can be done with a filar micrometer, even without any screw movement, by a little practice with the eye in transiting objects for both position and distance. It is in common use on simple equatorial mountings, which, when provided with tangent screws and handles, makes micrometrical work a pleasure.

(5434) F. M. M. writes: 1. I want to make simple motor (SUPPLEMENT, No. 641), and wind it for current from 9 cells storage battery, to be charged with 8 gravities. Should I use coarser wire in winding? If so, what number, and how much on field and armature, respectively? A. Make no change. 2. Would 12 plates to each cell, each plate 8×10, be large enough, or what would be the best size? A. Yes. 3. What horse power would above two cells develop in motor? A. ⅛ horse power.

(5435) Subscriber writes: You recently published an invention for a cockroach trap. Permit me to suggest a more simple and effective mode for the nuisance. Use empty wine bottles with the smallest quantity of wine remaining in them. These pests are hardly able to get out. The fumes of the wine are too much for them. I have seen bottles of them thrown overboard.

(5436) F. R. asks: 1. How many cells of storage battery will be required to light eight sixteen candle power twenty volt lamps? A. Eleven cells in series. 2. Where can the lamps be obtained and price? A. Address Edison Lamp Co., Harrison, N. J. 3. What size plates shall I use? A. About 6 by 8 inches. 4. Will gravity batteries in which the copper and zinc each has an active surface of eighteen inches do for forming and charging? A. Yes. 5. Can storage batteries be charged in series of say three? If so, how many gravity cells will it take? A. Yes; charge with five cells of gravity to two of storage, all in series.

(5437) N. F. Library, Newton, Kans., asks if water can be lifted from the bottom of a well 100 feet deep, 85 feet of water in it, by putting a check valve every 16 feet in the pipe, a foot valve at the bottom of pipe, the pipe filled with water. Or is it possible to lift it over 33 feet? A. The check valves are of no value in adding to the lift of the pump, but rather a hindrance, by their weight. Water in solid column can only be lifted possibly 33 feet, but practically about 28 feet from the pump bucket.

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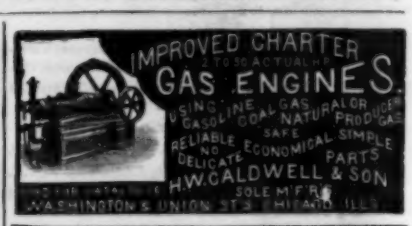
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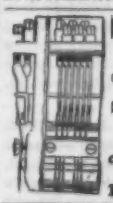
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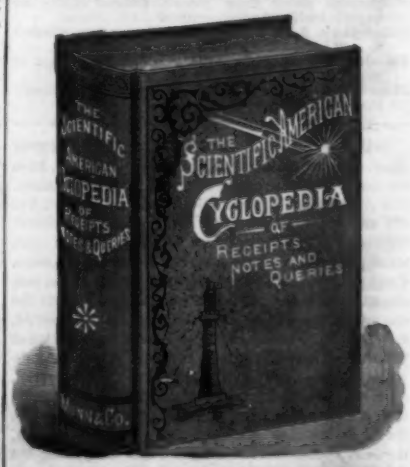

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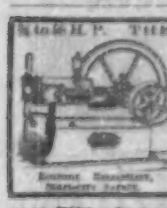

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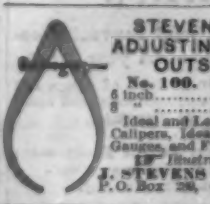

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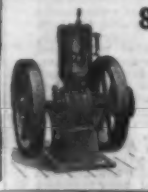

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This Company owns the Letters Patent No. 186,787, granted to Alexander Graham Bell, January 30, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

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